$1.00 the copy

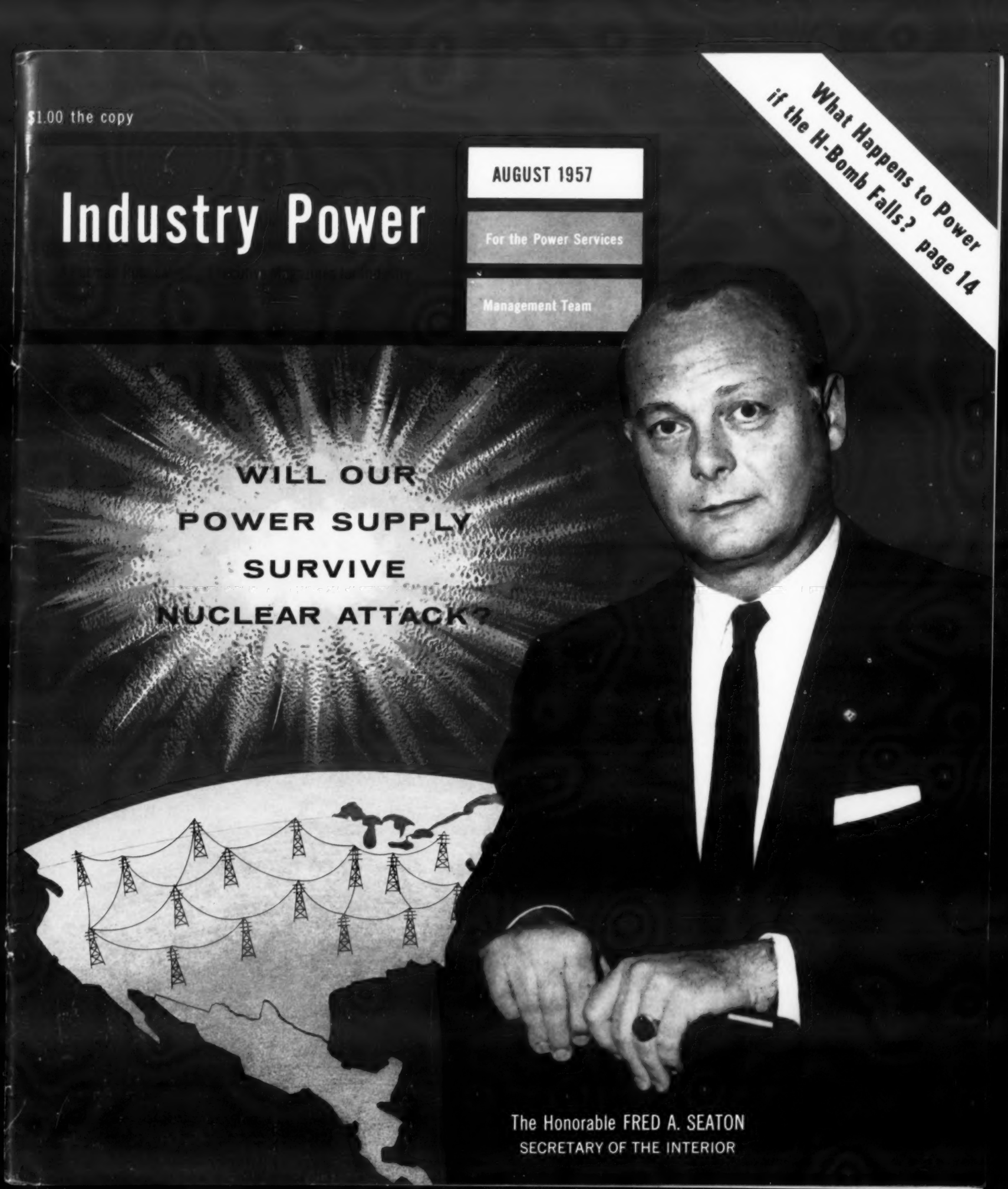
Industry Power

AUGUST 1957

For the Power Services Management Team

What Happens to Power if the H-Bomb Falls? page 14

WILL OUR POWER SUPPLY SURVIVE NUCLEAR ATTACK?

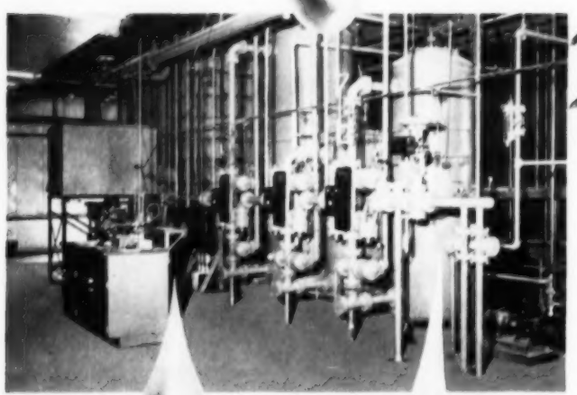


The Honorable FRED A. SEATON
SECRETARY OF THE INTERIOR

INFILCO

DEMINERALIZATION EQUIPMENT

..... engineered to meet your requirements



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It will pay you to investigate. Write today for Bulletin 1960-C. Inquiries are invited on all water and waste treatment problems, including boiler feed water makeup, process water clarification and purification, waste pollution control, material reclamation and related needs.

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Industry Power

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Volume 73 No. 3 August 1957

A Publication of
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Advertising Representation
will be found on page 55

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A PUTMAN PUBLICATION

Industry Power

FOR THE POWER SERVICES MANAGEMENT TEAM

VOLUME 73 NO. 3 AUGUST 1957

In this issue...

will our power supplies survive nuclear attack? 13
The Honorable Fred A. Seaton, Secretary of the Interior, reveals the overall planning behind national civil defense operations, with special emphasis on power generating and distributing facilities.

operation alert 1957 14
Staff editor John Runyan visits Oklahoma City for on-the-spot photos of Oklahoma Gas & Electric Co.'s part in recent nation-wide simulated hydrogen bomb attack. OG&E's plan could serve as prototype for all generating plants.

planned maintenance saves dollars 16
Eli Lilly's record-keeping system provides sound basis for intelligent replacement policy. Gives information on manufacturer reliability, amount and cost of maintenance, equipment performance.

Convair solves its lubrication problems 20
Manufacturer's directions must be carefully followed for proper lubrication of engines, motors, other industrial equipment. Convair engineers use charts to guide maintenance men through entire lubrication process.

power basics for today's industry
fluid mechanics 22
Part I — Fundamentals and Definitions — explores application of basic laws of mechanics to the motion of fluid bodies, including methods of flow analysis, *Bernoulli's Theorem*. Density and viscosity are defined.

fast rescue operations 24
Picture story of rescue kit that includes hydraulic-powered pump and ram operated by remote control for hoisting, hauling, or pushing heavy debris for quick emergency rescue operations.

a solution to fan blade erosion 25
Problem of eroding fan blades has, by many, been relegated to the ranks of that frustrating group labeled "no known solution." Now, at last, an expert reveals his imaginative solution.

using dc for control 34
General Steel Castings, with all variable-speed motors and overhead cranes operating on direct current, devise way to eliminate danger of costly shutdowns from direct current power supply failure.

monthly features...

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news in photos	18	advertising index	53
new products	26	the locator	53

new TUTHILL SU PUMP UNIT

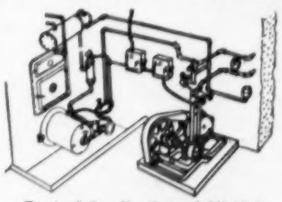
- For Handling Heavy Fuel Oils
- In Packaged Boiler and Commercial Heating Applications

Economically priced, TUTHILL'S SU PUMP UNIT has been specifically developed for handling heavy fuel oils in commercial heating applications and with packaged boilers.

This "v" Belt Driven Unit is compact—complete units measure only 24¼" x 14⅜". Quiet operation is insured by the 2 or 4 "v" Belt Drive and the integral gear positive displacement pump design.

Construction features which provide dependable trouble-free operation, lower maintenance costs, include two ball bearing pillow blocks, one point take-up for simple adjustment of belt tension, removable belt guard and new fabricated steel base with versatile motor mounting.

SU PUMP UNITS can be furnished with a wide variety of pumps and motors for pressures up to 300 psi, capacities to 2030 gallons per hour. Sub-assemblies of pump, stub shaft, pillow block and sub-base are also furnished separately as a unit for incorporation into systems by boiler and furnace manufacturers. Write today for complete information.



Typical Application of SU Unit

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951 East 95th Street, Chicago 19, Illinois
Gentlemen:
Please forward Catalog describing Tuthill SU Pump Units.
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951 East 95th Street, Chicago 19, Ill.
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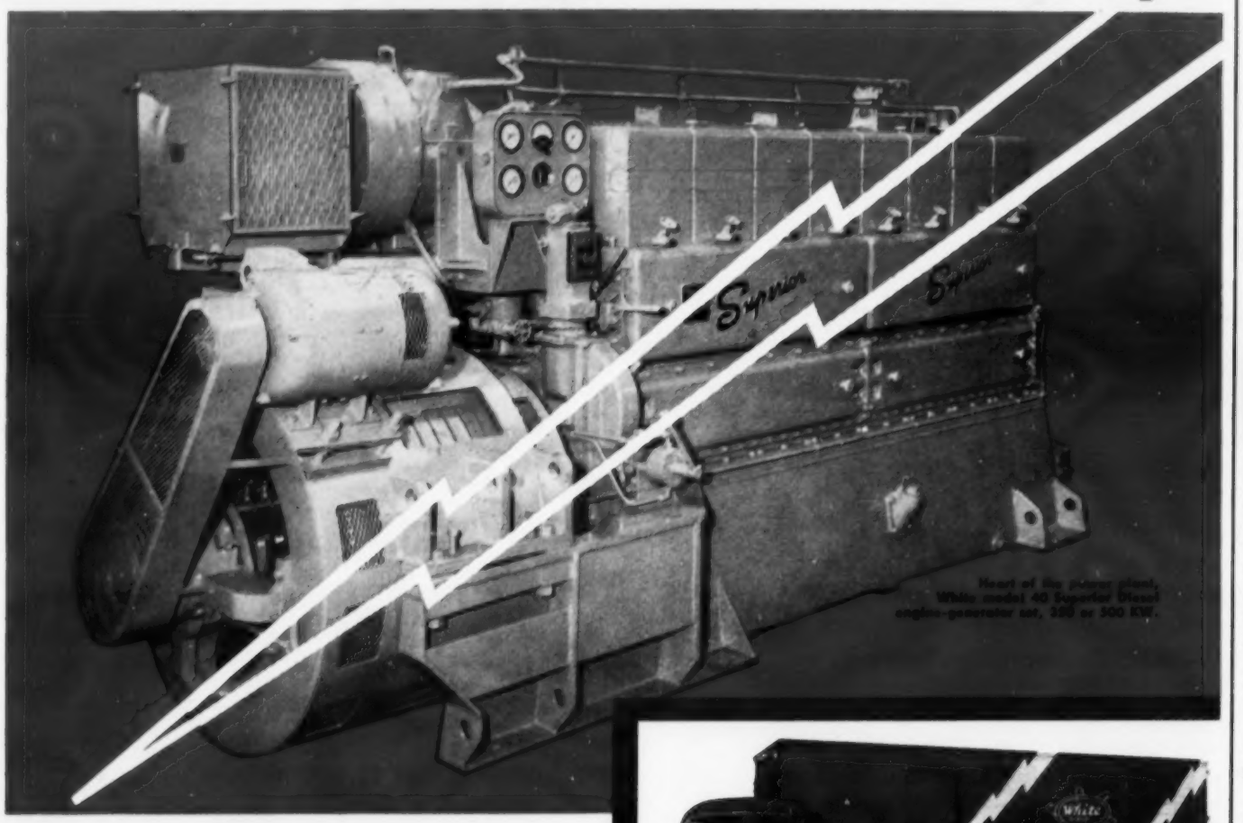
NOW! for emergency, supplementary or base power . . . in a hurry!



Heart of the mobile plant: White model 40 Superior Diesel engine-generator set, 350 or 500 KW.

send a WHITE DIESEL MOBILE GENERATOR PLANT anywhere...anytime!

White 3000 tilt-a-cab tractor and trailer hauls power plant over highways as semi-trailer.

White's new mobile generator plant . . . *a powerhouse on wheels* . . . provides highly maneuverable, trouble-shooting electric power to restore power quickly in flood, fire, storm and other disaster emergencies! It is also especially designed to provide dependable standby or supplementary power for industry, hospitals, utilities and municipalities during temporary or seasonal situations; and for use in construction and mining projects where power may be required.

The heart of the unit, a compact, high output, White Model 40 Superior Diesel engine and a 350 or 500 kilowatt capacity generator is built into a trailer which is hauled wherever needed by a White 3000 Series tilt-a-cab tractor. The unit is completely self-sufficient, and one man can operate it at a single control panel. Full load power is supplied immediately, as soon as the necessary connections are made. All components are time-proven, standard production items.

Superior ENGINES · ATLAS Imperial DIESEL ENGINES · White DIESEL

Write for complete information.

White Diesel

WHITE DIESEL ENGINE DIVISION

***THE WHITE MOTOR COMPANY** Plant and General Offices, Springfield, Ohio*

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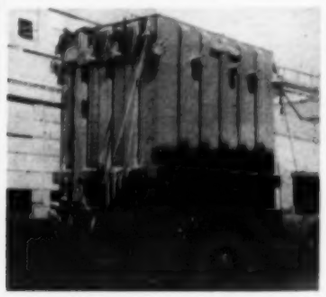
IP news

Ship world's most powerful generator transformer

Huge new generator transformer — largest ever built — was recently shipped by Westinghouse Electric Corp. to the



Detroit Edison Company's River Rouge plant. Generator transformer unit will boost output voltage of utility's 325,000-kw turbogenerator from 17,300 volts to 129 kv. Installed weight of 24-ft high, 26-ft long, and 17-ft wide unit is 458,000 lb. Unit was shipped in a one-piece tank minus bushings, coolers, and oil.

Managerial talent search outlined by conference

At a recent National Industrial Conference Board meeting, report on results of a 2-year study on selection of company executives was presented. Most companies agree on the scarcity of executives but few have adopted any systematic approach of their own. Results show that merit ranked highest in selecting executives (55%). Relying on natural selection, or waiting for the cream of capable men to rise to the top, still has many adherents. Concensus shows that college graduates are preferred as executives of the future.

Service firm's president denies monopoly claim

Fred C. Gardner, President of Ebasco Services, Inc., in reply to Senator Kefauver's statements, emphatically denied any implication of control or influence over any utility company. Mr. Gardner said, "There are more than 5000 pages of sworn testimony in Washington as to the nature of our business and the services we render our clients . . . Ebasco doesn't own

any utility companies; doesn't control any utility companies; doesn't dictate policy to anybody." Gardner also stated that Ebasco's services was formed in 1935 with SEC approval. They have operated continuously under such regulation and scrutiny and have never violated an order of the Commission.

First welding fittings forged from zirconium

Welding fittings forged from zirconium, now give fabricators high degree of stability under radiation in nuclear reactor installations. Zirconium fittings provide excellent resistance against corrosion attack and have a very low thermal cross section (0.18 Barns). They possess relatively good strength up to moderately high temperatures.

Court backs FPC authority on Niagara Falls power

A U. S. Court of Appeals ruled the FPC can authorize Niagara Falls power development, despite a 1950 treaty provision reserving this authority for Congress. The ruling invalidated the provision as not a binding treaty reservation. The court therefore ordered the FPC to reconsider the New York State power authority's request for a license to build about $566 million of new power plants at the Falls. According to the Court's two to one majority, the treaty provision doesn't deprive the FPC authority to issue a Niagara building permit.

UAW & ESA take stock after recent skirmish

Both UAW & ESA are busy "taking stock" after their recent defeat in the Minneapolis-Honeywell election last May 8. UAW executive council will reportedly reappraise its ambitious plans for organizing engineers and scientists at a future session. The ESA annual meeting will deal with the basic split between "all-professional" faction and the "mixed unit" faction.

Electronic computer interprets four languages

Electronic computer that interprets four foreign languages and automatically types out idio-

Check performance at a glance

Johnson Control Pressure Gauges are nothing more than ordinary air gauges. *But how they simplify and add to the efficiency of operating air conditioning, heating and ventilating systems!*

Control pressure gauges are *exclusive* with pneumatic control systems. Placed strategically throughout every Johnson System, they show the position of each controlled device and the exact operating response of each controller at a glance. During system adjustments, the gauges provide a visual on-the-spot check of performance without use of special test apparatus and without shutting down air conditioning, heating and ventilating equipment.

The system-wide display of operational data provided by unlimited numbers of inexpensive control pressure gauges is only one of many important advantages of Johnson Pneumatic Control Systems. An engineer from a nearby Johnson branch office will be glad to give you all the facts at your convenience. Johnson Service Company, Milwaukee 1, Wisconsin. Direct Branch Offices in Principal Cities.

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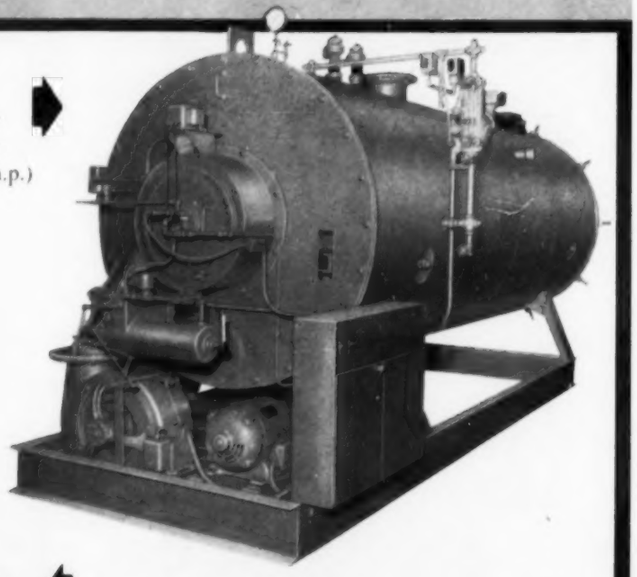
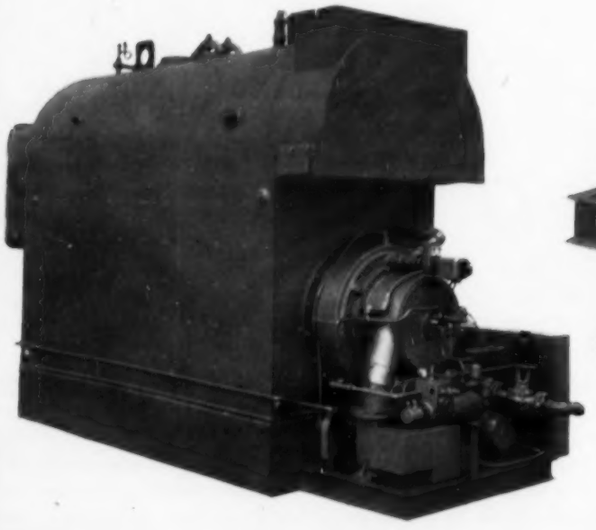
specify YORK-POWER

No longer are automatic boilers limited to one type of boiler. York-Power now offers a complete selection—2-pass Scotch Marines, 3-pass Scotch Marines, and 4-pass Fire Tubes—in a complete range of sizes. All York-Power boilers are automatically fired with oil or gas and can be furnished for combination gas-oil firing. All York-Power automatic boilers are complete on one skid and are fully wired. All York-Power automatic boilers are fire-tested for operational efficiency.

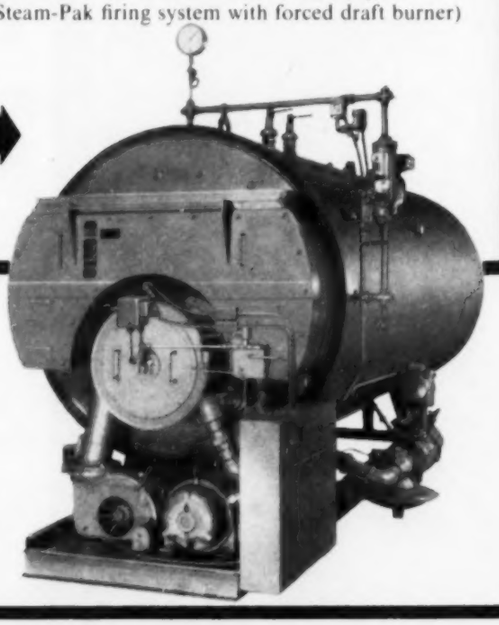
Steam-Pak Automatic Boilers
featuring 3-pass Scotch Marine design • High or Low Pressure Steam or Hot Water • 15 to 600 Horsepower
(Also available in Steam-Pakette design from 10 to 50 h.p.)





Fire-Pak Automatic Boilers
featuring 4-pass Fire-Tube design • Low Pressure Steam or Hot Water • 35 to 485 Horsepower
(Steam-Pak firing system with forced draft burner)

Scot-Pak Automatic Boilers
featuring 2-pass Scotch Marine design with either forced, induced or natural draft.
45 to 400 horsepower



Write today for specifications on the complete York-Power line of automatic boilers

Industrial Division
YORK-SHIPLEY, Inc.
YORK, PA.

Pioneer Specialists of Automatic Heat and Power
Also manufacturers of York-Power Burners

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lp news

matic English translations has been developed by a 32-year-old Hungarian technician at the California Institute of Technology. Datatron is the first real breakthrough toward a universal interpretation of all the world's tongues—and a common written language. Datatron does not merely produce a word-for-word record, but correctly renders thought or sense behind each foreign phrase. To prime electronic linguist, four specially-condensed dictionaries of Russian, French, German and Spanish were transmitted to its magnetic memory drum. These had been punched on paper tape in numerical computer language.

Industry promotions, appointments, transfers

Mr. Heinz Pagels is elected vice president and general manager of Detroit Stoker Company.

L. C. Dubs, president and general manager, of Canton Stoker Corporation, was re-elected president of the Stoker Manufacturers Association for an unprecedented 5th consecutive term. D. J. Sprague, chief engineer, Canton Stoker Corporation, was appointed head of the Engineering Committee of the Association.

Dubs Laegeler

Jules C. Laegeler is appointed Chief Engineer for the Frank G. Hough Co. Laegeler joined the company in 1951, was made senior project engineer in 1955 and departmental manager in 1956.

John J. Haroldson, Duluth Steam Corp., is elected president, National District Heating Association. William G. Gillim, Consolidated Edison Co., 1st vice president; George F. Prestwich, Philadelphia Electric Co., 2nd vice president; Albert F. Metzger, Allegheny County

Steam Heating Co., 3rd vice president. John F. Collins, Jr., was re-elected secretary-treasurer.

Harold J. Balhouse is appointed manager, Nuclear Division, Alloy Steel Products Company. Balhouse is a member of AMS, ASME, NACE, AMSPE.

Balhouse

McDowell

Donald M. McDowell becomes manager of engineering, Le Roi Division, Westinghouse Air Brake Co.

Emotional disturbances traced with magnetic pills

Magnetic pills, swallowed by patients, are traced by a magnetometer at the University of California to study effects of emotional disturbances on action of stomach and other organs. Pills' movements are charted and correlated with emotional variations. Magnetometer was developed by Irwin Laboratories, Los Angeles.

Mountains of paperwork clog the wheels of progress

Huge quantities of unnecessary paperwork are clogging operations and raising costs of business and government. Ben S. Graham, methods research director, Standard Register Co., claims that 12½% of the total national payroll is invested in paperwork. He criticizes the amount of time, effort, and money spent in keeping tab on pencils, paper clips, nuts, bolts and other small items. He states further that about half of the nation's $80 billion annual cost in paperwork fails to help others do better jobs.

Large nuclear fuel order awarded Sylvania-Corning

Sylvania-Corning Nuclear Corp. has signed a contract for 5000 nuclear fuel elements for the research reactor at Brookhaven National Laboratory. This contract (totaling $250,000) rep-

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"OUT IN THE OPEN"

vogt

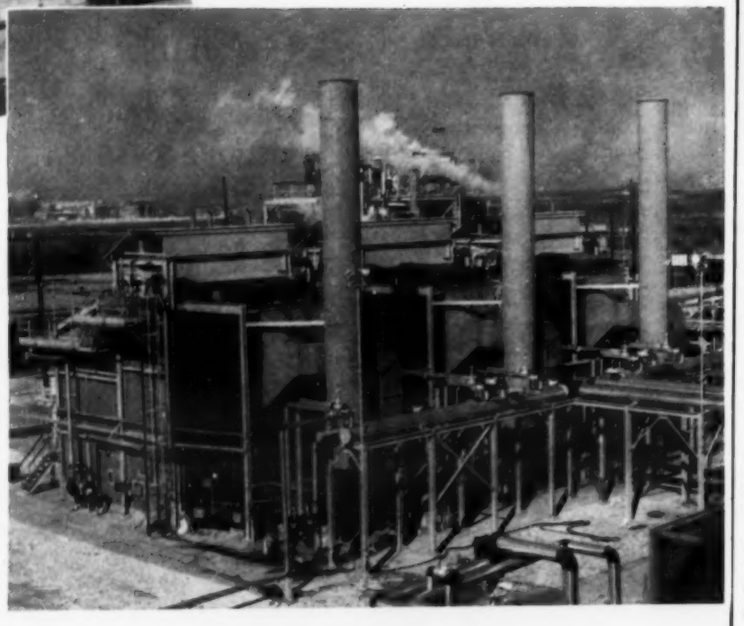
Steam Generators

STEAM GENERATORS for economical outdoor operation have been featured by Vogt for many years and serve leading chemical plants and petroleum refineries. Requiring no building for housing, such installations, as pictured here, produce more steam per dollar of investment and are a definite aid to lower production costs.

Get Vogt's recommendations for steam generators to meet your needs for power, processing, or heating, without obligation. Package type and custom built units are available in a wide range of types, capacities, and pressures to meet operating requirements.

Write for bulletins. Dept. 24A-BIP

Three 85,000 #/hr. steam generators in a Texas refinery.



An outstanding chemical plant served by three 150,000 #/hr. units.

OTHER VOGT PRODUCTS

Drop Forged Steel Valves, Fittings and Flanges — Petroleum Refinery and Chemical Plant Equipment
Heat Exchangers
Ice Making and Refrigerating Equipment

HENRY VOGT MACHINE CO., LOUISVILLE, KY.

SALES OFFICES: New York, Philadelphia, Chicago, Cleveland, St. Louis, Dallas, Charleston, W. Va., Cincinnati

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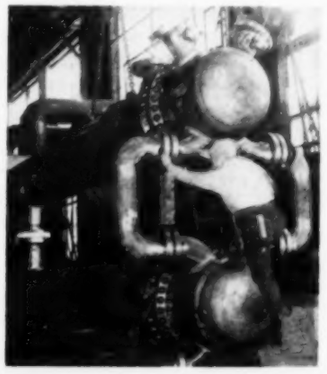
IP news

resents the largest number of atomic fuel elements ever ordered on the commercial market. Order calls for deliveries to begin next month and to continue at the rate of 500 per month for ten months. Fuel elements will contain 93% enriched uranium-aluminum alloy clad in aluminum. Improved utilization of the available U 235 is expected from new fuel elements. Up to 40% is expected to be "burned up" compared with 10% for natural uranium slugs.

Stainless heat exchanger for high-pressure use

Stainless heat exchanger, designed and built by M. W. Kellogg Co., a subsidiary of Pullman Inc., will withstand pressures above 600 psig and tem-



peratures above 650 F. Tubes were expanded into grooved tube sheets, rolled for full length of tube sheet, and seal welded with inert-gas tungsten arc welding. All welds were radiographed and die-penetrant tested. Heat exchanger unit will be installed in an English oil refinery. Sections will be stacked three high.

Need engineers? Here's your answer

Engineering pool helps alleviate shortage. New service provides any type of temporary technical help from accounting to X-ray specialists. Service offers competent technical help in more than two hundred categories. Mechaneering Inc. offers a monthly classification of their personnel pool. They guarantee highest performance and, in ad-

dition, state that no charge will be required for any individuals that can not perform suitable work. Literature is available from Mechaneers Inc., Westport, Conn.

Power problems pursue engineers to convention

The American Power Asociation, at its recent annual convention, ran into a crisis — a power shortage. A light failed on the speakers' podium at convention headquarters. The speakers were unable to see their texts. In exhibit halls, power supply was too weak to operate equipment on display. The last straw developed when a radio station engineer plugged his ac equipment into a dc socket and blew a fuse.

Societies announce honors winners

AIEE has raised eight members to the grade of fellow — the Institute's highest grade. Elevated members are George W. Baughman, vice president, Union Switch and Signal Division, Westinghouse Air Brake Co., Clifford A. Duke, Electrical Laboratory and Test Branch, TVA; John Grotzinger, manager Electrical Engineering division, Goodyear Tire & Rubber Co.; Marshall McKoch, vice president electrical operations, Public Service Company of Colorado; Carlisle K. Milner, vice president, The Ohio Bell Telephone Co.; Harold L. Rorden, high-voltage engineer, American Gas and Electric Service Corp.; Clifford L. Sampson, vice president, operations, Northwestern Bell Telephone Co.; Randall B. Shipley, electrical engineer, TVA.

Donald A. Quarels, deputy secretary of defense, has been named as honorary member of the AIEE, highest honor of the society.

ASME has designated Oscar B. Schier, II, secretary-elect of the society by unanimous vote. He will succeed Clarence E. Davies who will retire after 23 years of service for the society.

High-temperature, gas-cycle nuclear system urged

ALCO Products, Inc., in cooperation with Sanderson and Porter, New York City engineering-construction firm, is de-

(more on page 12)

View of lake steamer equipped with self-unloading boom, discharging coal at destination. United Electric Coal is moved on barge tows on the Illinois and Mississippi waterways and to Chicago for transshipment on lake steamers to Great Lakes ports.

BETTER SERVICE

Through Improved Production and Marketing

UNITED ELECTRIC LOOKS AHEAD TO YOUR FUTURE NEEDS FOR COAL

For many years, United Electric has been building production and service facilties to meet your needs today and in the years to come.

New mines, larger, more modern production facilities, pioneering in the development of the all-water route for shipment of coal to Chicago and Great Lakes ports. These are only part of the reason why so many major utilities and industries depend on United Electric regularly for such large tonnages of precision-prepared coal.

It will pay you to get the full story of United Electric's modern production-marketing service.

Loading coal in the pit at one of United Electric's mines. Just ahead in the background a shovel is stripping overburden.

Cuba Mine, one of United Electric's large preparation plants producing huge tonnages of precision-prepared coal.

FIDELITY
domestic and industrial stoker coal

CUBA-BUCKHEART
precision prepared coals

RUBY
washed West Kentucky No. 11 for industrial and domestic use

BUFFALO CREEK
washed West Kentucky No. 6 industrial and domestic stoker coal

MARY MOORE
No. 7 Illinois for industrial and utility use

•ruby

THE UNITED ELECTRIC COAL COMPANIES

CHICAGO, 307 N. Michigan Ave., Phone CEntral 6-6580 • PEORIA, Commercial National Bank Building, Phone 3-3711 • ST. LOUIS, Ambassador Building, Phone GArfield 1-3732

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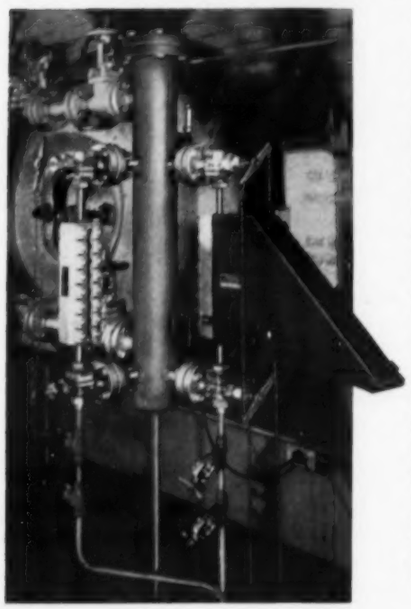
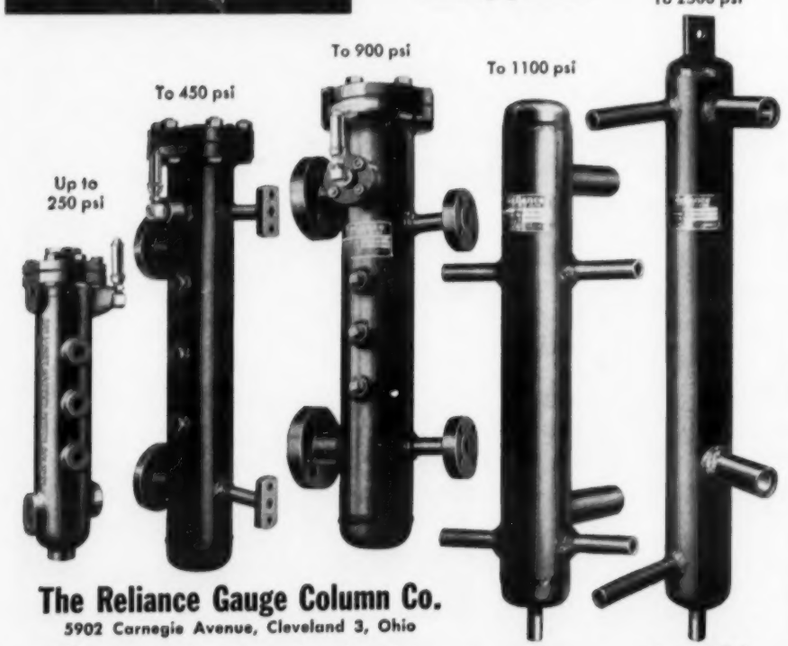
Insure safe, continuous boiler operation with **Reliance** Water Columns



Water columns have been around for a long time — ever since Reliance introduced the first one in 1884. Its chief reason for existence then was to carry the float-operated whistle alarm and mechanism, to warn operators of dangerously low water in the boiler. Since then, the water column has been developed in various styles and capacities to meet any power plant need. They are used on most boilers today as an accepted necessity, although many old time engineers — and thousands of young ones — can't explain their full usefulness. If you'd like to know "why a water column", write for free copy of our Liquid Level Letter No. 11.

Reliance makes Water Columns in seven pressure categories, five of which are represented below. And complete "trim" — gage cocks, gage valves, gage inserts, special gages and direct-to-drum assemblies. Write for information on equipment suited to your working pressure.



The Reliance Gauge Column Co.
5902 Carnegie Avenue, Cleveland 3, Ohio

The name that introduced safety water columns....in 1884

Reliance®

BOILER SAFETY DEVICES

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this month's comment . . . .

. . . the power of a postcard

A friend of mine always has a pack of stamped postcards in his desk.

What does he do with them? He writes to equipment manufacturers – with criticisms and suggestions.

Perhaps he's had a knotty problem in plant operations, and he sees where development of a certain type of equipment would eliminate that problem in the future.

Or, he may read an advertisement and it stimulates an idea that he passes on to the equipment manufacturer. A magazine article may cause him to ask if the manufacturer's engineers have read it.

Those who receive his postcards value them more than requests for a salesman to call! You see, a manufacturer receives very few communications of ideas from men who use the equipment he manufactures. He knows that many such ideas exist – his salesmen dig them out – but rarely do customers take time to write.

How much better it would be if more of us, like my friend, would jot down an idea or comment on a postcard and send it directly to the manufacturer.

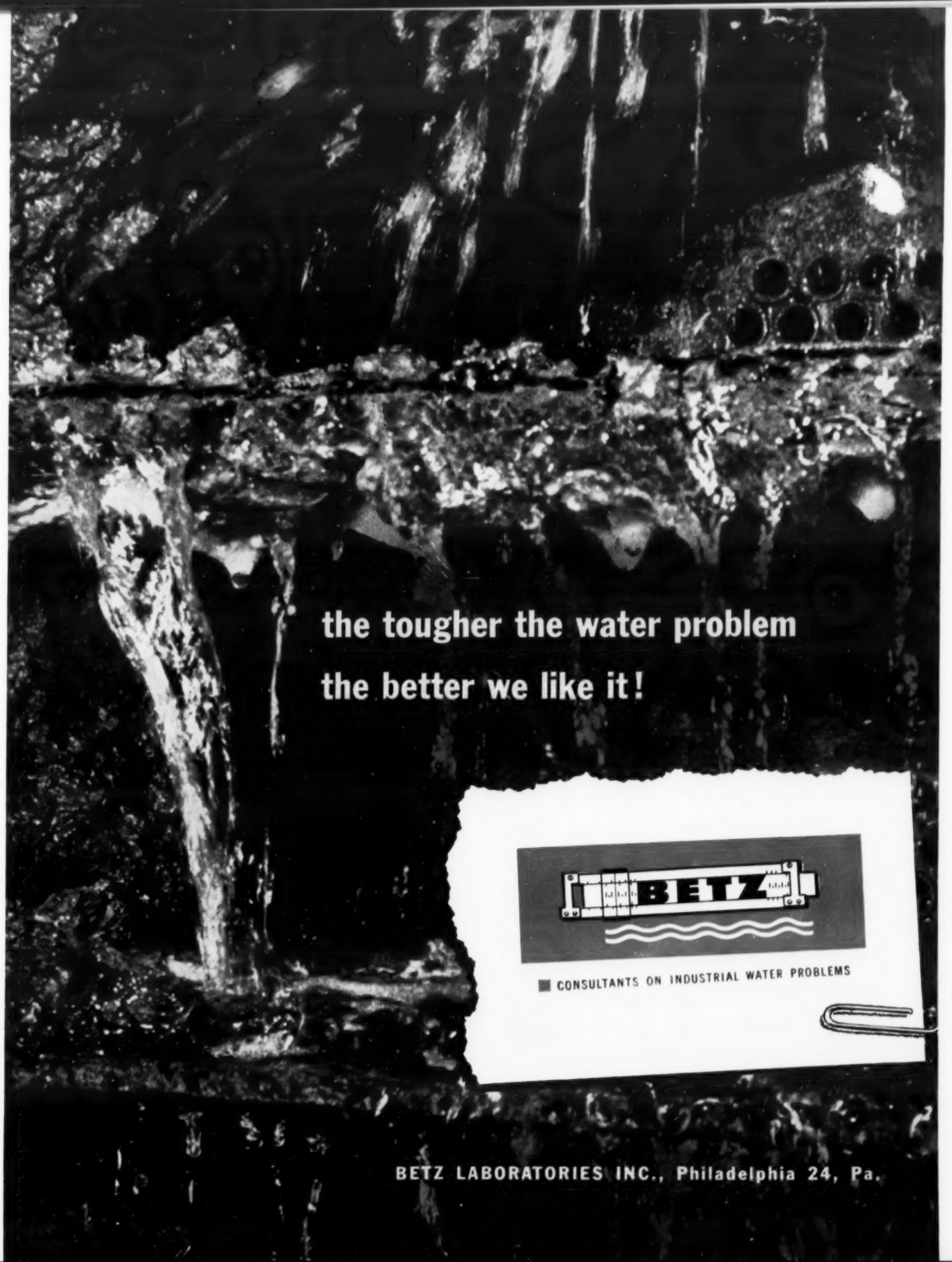
An increased flow of such communications would spark more rapid improvement in development and application of plant equipment. You, the user, are the key man in the designing of new or improved equipment. What you need, the manufacturer will produce. But, you must tell him what you need.

Whether your thought has to do with equipment for steam, electricity, compressed air, fluids, mechanical power transmission, waste disposal – any of the power services – send it to the person who can do something about it, send it to the manufacturers of power services equipment.

If you have a thought that several manufacturers should consider – send a postcard to us. We'll bring it to their attention.

John Paul Taylor

John Paul Taylor
Editor and Publisher


the tougher the water problem
the better we like it!
BETZ
CONSULTANTS ON INDUSTRIAL WATER PROBLEMS
BETZ LABORATORIES INC., Philadelphia 24, Pa.

signing a nuclear gas-system reactor. Heart of the pebble-bed graphite reactor is a collection of parallel tubes filled with small graphite spheres that contain uranium. Heat is transferred from the spheres to a steam generator by helium gas, which is continuously recirculated through the system. Proposed reactor system would generate 50,000 kilowatts of heat and be capable of producing steam at 1450 psi and 1000 F. ALCO engineers say that only by achieving such pressures and temperatures, can advantage be taken of modern high-pressure turbines and generators.

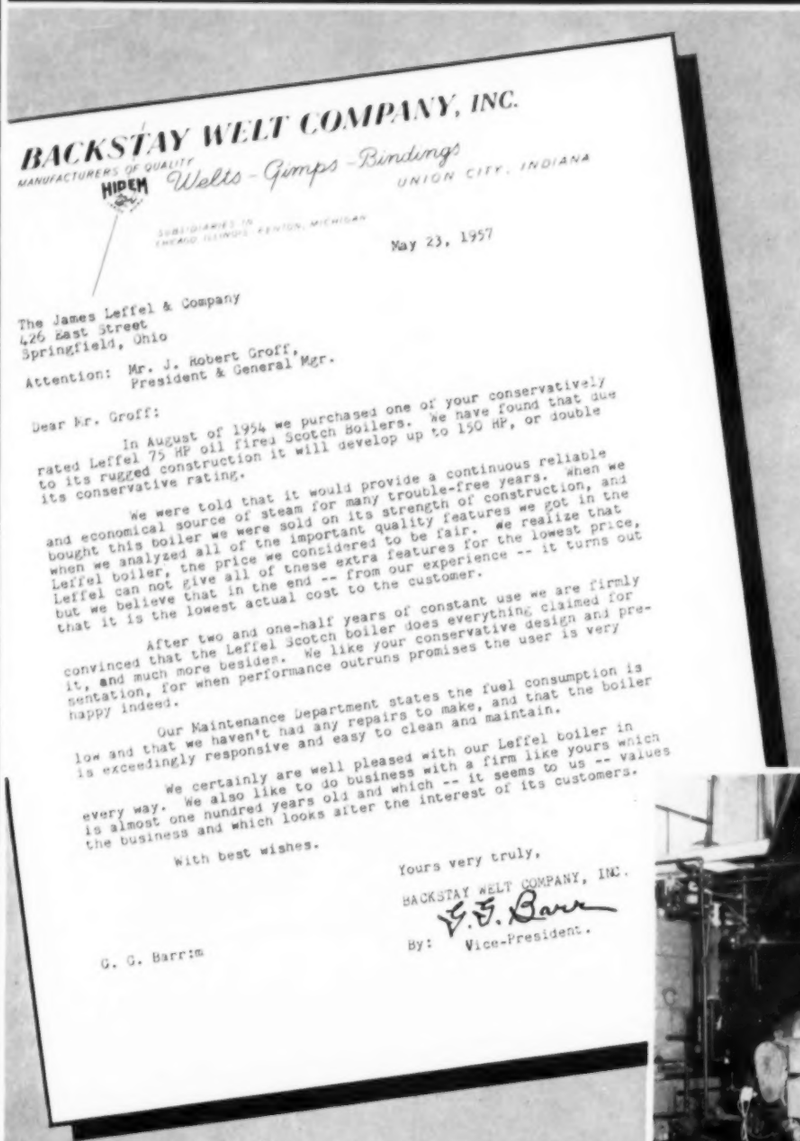
Radar maps, made in flight, can be used immediately

An automatic radar photograph of the ground beneath an airplane can now be made in only twenty seconds. Radar recorder works equally well day or night, above clouds or in clear weather. New device requires no operator. Combines electronics and photography to determine the airplanes' exact position and true flight paths at any time desired in flight, without relying upon memory or radio equipment on the ground.

Mergers continue — are they good or evil?

National Association of Manufacturers' Research Department shows that widely publicized statements about mergers — supposedly based on statistical evidence — actually rests on flimsy support. NAM's report refutes recent Congressional Committee report (. . . . Corporate mergers and acquisition, for instance, which at a rate of 846 in 1955 attained a 25-year peak, climbed still farther in 1956 to a new quarter-century record of more than 900 competitively significant mergers. The impact of unrestrained merger activity on competition and on smaller companies, which are trying to retain their grip on existence, is obvious. . . .). NAM's report says that 1956 mergers represent only two one-hundreths of one per cent of independent business firms in existence. ♦ ♦

LOW-COST STEAM IS A REALITY AT BACKSTAY WELT COMPANY



BACKSTAY WELT COMPANY, INC.
MANUFACTURERS OF QUALITY HIDEM Welts - Gimps - Bindings
UNION CITY, INDIANA
SUBSIDIARIES IN CHICAGO, ILLINOIS - KENTON, MICHIGAN

May 23, 1957

The James Leffel & Company
426 East Street
Springfield, Ohio

Attention: Mr. J. Robert Groff,
President & General Mgr.

Dear Mr. Groff:

In August of 1954 we purchased one of your conservatively rated Leffel 75 HP oil fired Scotch Boilers. We have found that due to its rugged construction it will develop up to 150 HP, or double its conservative rating.

We were told that it would provide a continuous reliable and economical source of steam for many trouble-free years. When we bought this boiler we were sold on its strength of construction, and when we analyzed all of the important quality features we got in the Leffel boiler, the price we considered to be fair. We realize that Leffel can not give all of these extra features for the lowest price, but we believe that in the end -- from our experience -- it turns out that it is the lowest actual cost to the customer.

After two and one-half years of constant use we are firmly convinced that the Leffel Scotch boiler does everything claimed for it, and much more besides. We like your conservative design and presentation, for when performance outruns promises the user is very happy indeed.

Our Maintenance Department states the fuel consumption is low and that we haven't had any repairs to make, and that the boiler is exceedingly responsive and easy to clean and maintain.

We certainly are well pleased with our Leffel boiler in every way. We also like to do business with a firm like yours which is almost one hundred years old and which -- it seems to us -- values the business and which looks after the interest of its customers.

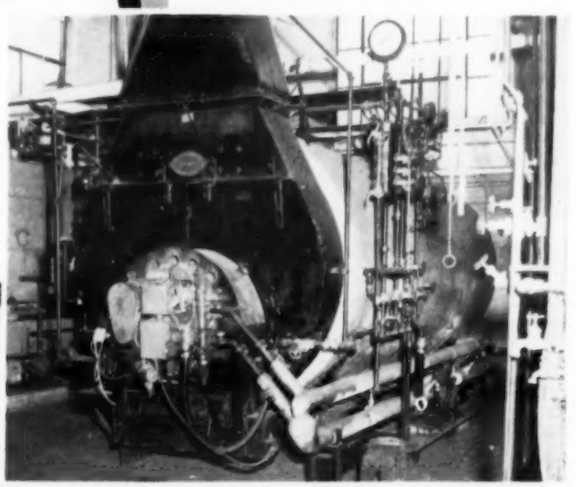
With best wishes.

Yours very truly,
BACKSTAY WELT COMPANY, INC.
By: E. G. Barr
Vice-President.

G. G. Barrim

Leffel 75 H.P. boiler in operation at the Backstay Welt Company, manufacturers of "HIDEM" moldings.

5-1-57



The solidly constructed Leffel boiler at the Backstay Welt Company, Union City, Indiana, provides efficient, economical steam even when operating at double its normal rating. And it requires very little upkeep. The heavy-duty construction, economical maintenance, and extra-power of Leffel boilers can make low-cost steam a reality for you, too.

HEAVY-DUTY CONSTRUCTION—Leffel boilers are constructed from finest quality, heavy gauge materials. They're designed and built to withstand the tremendous stresses and strains of maximum temperature variation so common in a scotch-type boiler.

ECONOMICAL MAINTENANCE — Time and money are saved in maintenance of Leffel boilers because they're easy to clean, easy to operate. A Leffel boiler doesn't require a corps of maintenance engineers to keep it operating continuously at peak efficiency.

EXTRA-POWER—Leffel boilers operate efficiently and economically at double their normal rating.

Heavy-duty construction, economical maintenance and extra-power of Leffel boilers add up to low-cost steam. Leffel boilers all over the country are still providing this low-cost steam, even after 25 to 50 years of efficient service.

Before you buy a boiler . . . take a look at Leffel. Available in sizes to produce 6 H.P. to 500 H.P.; coal, oil or gas-fired.

MAIL COUPON TODAY for FREE CATALOG. Our representative will be glad to help you plan your next boiler installation. There's no obligation.

THE JAMES LEFFEL & CO.

FOUNDED IN 1862

MORE EFFICIENT STEAM GENERATION FOR 95 YEARS

FREE CATALOG

THE JAMES LEFFEL & COMPANY
Dept. I, SPRINGFIELD, OHIO

☐ Please send me catalog and other descriptive literature on Leffel Scotch Boilers.
☐ Please have your representative call.

Name _____ Title _____
Company _____
Street _____ City _____ State _____

Circle 125 on READ-N-CIRCLE card for more data

Will our Power Supply survive nuclear attack?

FRED A. SEATON
Secretary of the Interior

About Fred A. Seaton

Secretary of the Interior, the Honorable Fred A. Seaton, was born in Washington, D.C. on December 11, 1909. He attended Manhattan, Kansas, public schools and Kansas State College. While a student at Kansas State, he was director of sports publicity for the college, and combined his interests in both fields as a radio sports announcer following his college days.

He began his newspaper career as a wire news editor on the Manhattan, Kansas, Morning Chronicle in 1932. He is past president of the Associated Press Newspapers of Nebraska and of the Inland Press Association.

Mr. Seaton served two terms in the Nebraska State Legislature from 1945 until 1949. He was chairman of the Nebraska Legislative Council in 1947-49, and a member of the Nebraska Judicial Council from 1948 until 1950.

He was appointed to the United States Senate on December 10, 1951, to fill the vacancy left by the death of Nebraska's Senator Kenneth S. Wherry.

He received an honorary doctor of laws degree from Kansas State College and an honorary doctor of humanities degree from Maryville College, Maryville, Tennessee.

Mr. Seaton was appointed the 36th Secretary of the Interior by President Eisenhower on May 28, 1956. He took the oath of office following unanimous approval of his nomination by both the U.S. Senate Interior and Insular Affairs Committee and the Senate.

IF THE UNITED STATES is ever the target of a nuclear attack, one of the most vital tasks during the post-attack period will be that of keeping electric power on the line. In cooperation with electric utilities all over the country, the Department of the Interior is now working on plans for just such an emergency — plans which all of us devoutly hope will never have to be used.

To realize the immensity of this assignment, you have only to think of the havoc that even a few direct bomb hits on power centers could cause. In the post-attack period, electricity will be needed not simply to supply essential production and satisfy military demands, but also to help save millions of lives.

As a first step in assuring that electricity will be available where most needed during such a period, we are mapping out 16 areas, with interconnected systems of operation. Within these areas, the heaviest burdens will necessarily fall upon utilities that generate huge blocks of power and that have major transmission line networks. But other suppliers—indeed, many of America's 4000 and more utilities — will also have important work to do.

Each area will have a power director. He will be an experienced utility man, familiar with his region's power operations. It will be his task to coordinate emergency activities. In the event of his death, his work will be carried on by an alternate, or alternates. The alternates to the power director and other key people will be named from locations scattered throughout their regions.

We are working out means of delegating authority to our area directors, and in turn to their alternates, so that they can carry out their responsibilities even without central direction, should that prove necessary. We hope to be able to give them sufficient authority to carry out on their own a whole range of possible emergency actions.

The area director will have to direct and curtail energy flows; assign priorities for use of equipment; work with other area directors in making inter-area transfers of energy, equipment, and supplies; and requisition and allocate materials and supplies in the inventories of utilities in his area. He will have, in short, the authority to do whatever may be necessary to help provide electric power for civilian survival and for military retaliation.

One of the director's main preparatory jobs will be to plan for uniting his area's power pools into a single entity for emergency wartime use. Some areas already have efficiently operating pools (these are varied in structure and operation), which serve normal peacetime purposes. It is our purpose to use these existing organizations, coordinating them on a national basis.

In all regions, a close working relationship must be maintained between the electric utilities and all levels of the civil defense organization. This relationship is important for so-called support areas, as well as for primary or secondary target areas, since no one knows when a "support" area may become a primary energy supplier.

This cooperation has already been established in most regions. But it must be a continuing activity. Local cooperation will not only keep civil defense officials aware of electric power functions and readiness; it will keep utilities informed of local, state, and national civil defense planning that affects them.

From some of these details you can see that our plan, while national in scope, leaves room for a good deal of local autonomy and difference. The Department is providing policy guidance; but it is also asking each area director to work out details for an organization that will best meet the needs of his region.

Several weeks ago this plan was tested in Operation Alert 1957, this year's civil defense training exercise. In the course of this exercise another group of organizations — the new Regional Mobilization Committees — came into operation for the first time. These Committees, separate from the area directors' organizations, are field arms of the Office of Defense Mobilization. In any national emergency it is they who will determine priorities in the distribution of energy. During any rehabilitation period, they will determine priorities for plant reconstruction.

On each of these regional committees, there will be a power representative who will provide the Committee head — known as the Regional Mobilization Coordinator

(continues on page 19)

An H-bomb could mean disaster. Here is . . .

Operation Alert 1957

a photo story of civil defense in action at Oklahoma Gas & Electric Co's power plants.

JOHN R. RUNYAN
Assistant Editor

Map overlay of bomb destruction zone and lethal fallout pattern is posted by Dean Weber, Transmission and Distribution department. Map shows Region 12, DEPA, also shows member systems in Southwest Power Pool area. All available information that affects entire system is plotted on this map.

This small instrument, no larger than a fountain pen, is a dosimeter. Available to all personnel, it determins number of roentgens absorbed. When excess radiation is indicated, worker must be removed from decontaminated area.

On the scale map showing generating stations in OG&E system, Safety Engineer J. R. Steele plots bomb information with T. H. George, Generating Department. Stations not destroyed in fallout pattern area are operated by rotating crews.

HERE IN THE HINTERLANDS of America . . . an area which might be regarded by bomb-conscious seacoast areas as "safe" from possible H-bomb attack . . . Oklahoma Gas & Electric Company has a blueprint for power survival, a blueprint it might be well for other areas to investigate.

For, if an H-bomb should ever drop on the vast area served by OG&E, they are as ready as any organization can be said to be ready. Ready to survive disaster and to provide vital, uninterrupted power service when and where it will be most needed.

Survival centers, rescue points, emergency hospitals, and key plants designated by Civil Defense authorities will get needed power to operate because of the careful planning and training carried out by this giant southwest public utility.

First step in setting up OG&E's disaster plan was designating Otis Howard as Emergency Coordinator. Mr. Howard and his staff compiled an emergency manual for every person in the entire organization, outlining duties, setting up lines of communication, and providing the steps necessary for essential functions to continue in the event of disaster.

Operation Alert 1957 (The nationwide Civil Defense H-bomb exercise) provided another test for OG&E's master plan to be further evaluated.

Key point in the disaster set-up is the Dispatcher's office, located in downtown Oklahoma City. Friday, July 12, was a busy day here.

Early Friday morning, an alert flashes from Civil Defense headquarters. This advance warning sets in motion OG&E's Emergency plan, coordinated by Director Howard. At the Dispatcher's office, Head

Dispatcher R. R. Baze starts the wheels in motion. Using prevailing wind information received by direct teletype from the weather bureau, map overlays of possible bomb destruction centers and fallout patterns are prepared for various sizes of bombs. This information, of course, has been gained from nuclear bomb tests.

At 2:10 p.m., word from CD Disaster Headquarters comes to Dispatcher Baze that an H-bomb, size estimated to be 5 megatons, has "exploded" at ground level on Oklahoma City. Immediately, Baze calls key personnel from Generating, Transmission and Distribution, Safety, Personnel, and other departments to report to the emergency center.

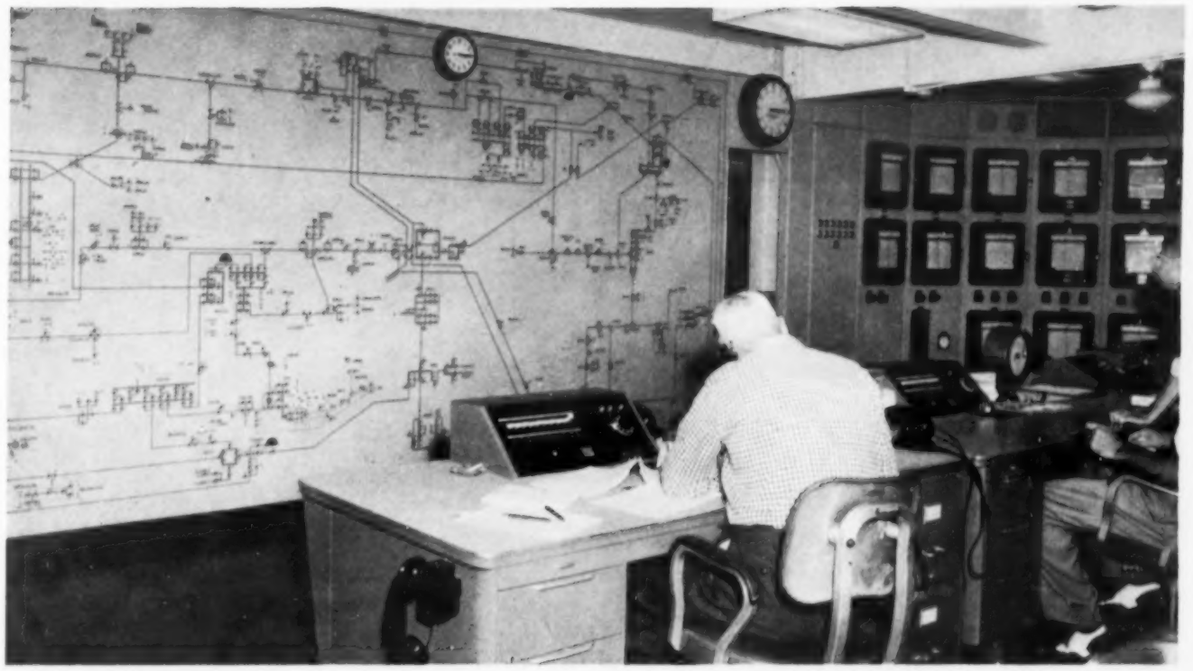
Within 15 minutes, these key people converge on headquarters to aid in keeping power service flowing. Moving into the map room, map overlays are checked and plotted on three maps, showing:

- Generating stations in the system.
- Transmission and distribution system.
- Power distribution and generating facilities of other members of the Southwest Power Pool. This is an inter-coordinated power system of utilities in the Southwest area, all members of Region 12, Defense Emergency Power Administration, set up by the Department of the Interior. (See Secretary Seaton's Forum article on page 13 of this issue.)

overlay shows extent of damage

From the map overlays, generating department personnel decide which facilities have been destroyed, and which are, or soon will be, untenable because of radiation fallout. Personnel of Transmission and Distribution department are at the same time estimating load loss and deciding necessary measures to insure power service from mobile generators to previously designated disaster centers. On the basis of their estimates, a decision is reached as to next steps to be taken. These include line restoration, decontamination, personnel protection, etc. It may well be noted that in Operation Alert 1957, and in previous tests, load loss usually exceeds loss of generating facilities, so that priority is given to line restoration, mobile generators, etc., rather than on restoring generating stations.

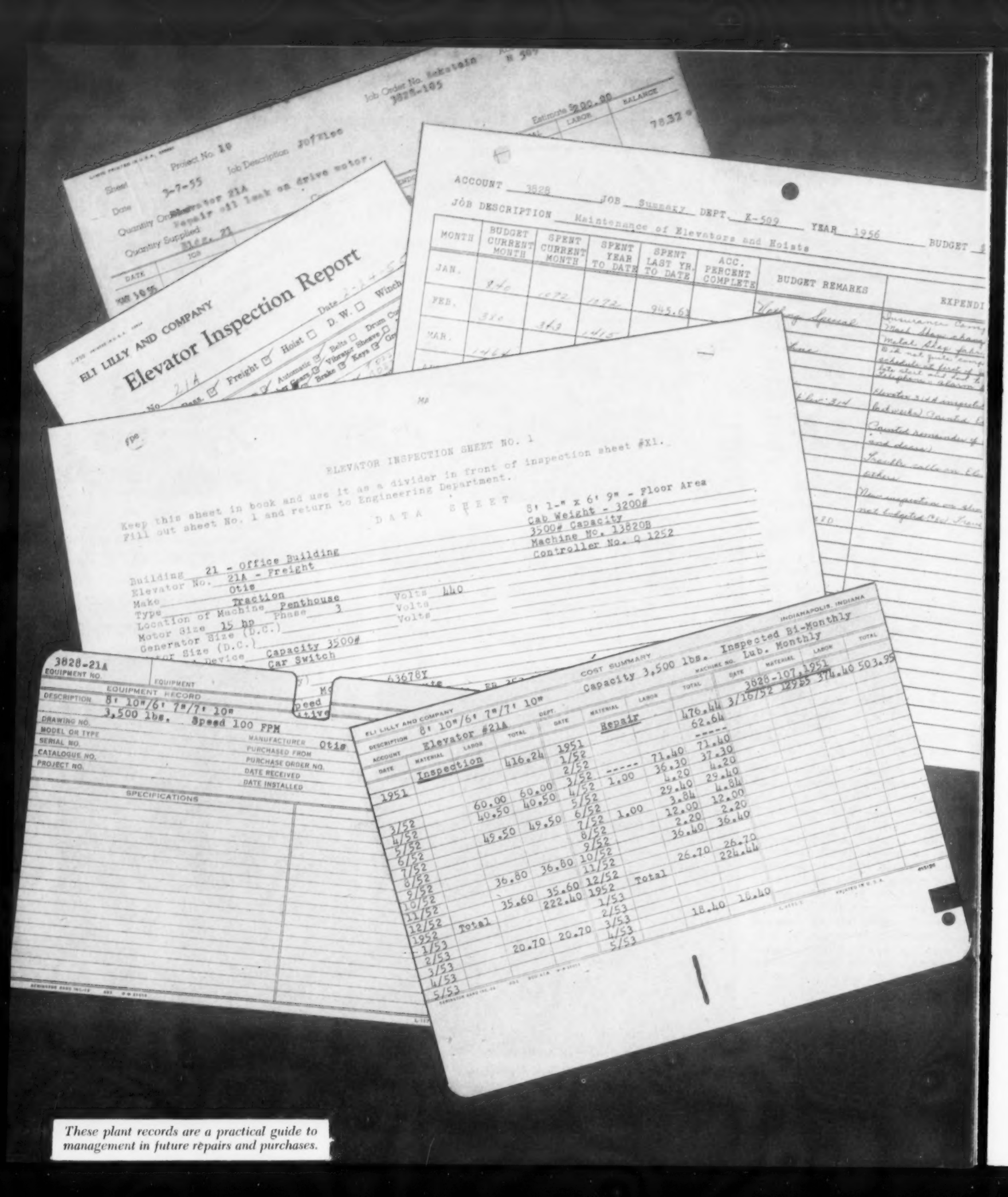
(continues on page 44)



Decisions made concerning dispatching of work crews, decontaminating teams, line crews, are fed to this emergency dispatching panel where information is sent throughout entire system by microwave.

Top photo shows servicemen with Geiger counter used to check radiation. They will report findings to emergency headquarters. Bottom, work crews, with emergency equipment, ready to roll.

Map, above, shows entire OG&E system. On this map is plotted loss of transmission lines, substations, and generating stations to destruction or fallout.



ELI LILLY AND COMPANY

Elevator Inspection Report

ELEVATOR INSPECTION SHEET NO. 1

Keep this sheet in book and use it as a divider in front of inspection sheet #X1.
Fill out sheet No. 1 and return to Engineering Department.

DATA SHEET

Building 21 - Office Building
Elevator No. 21A - Freight
Make Otis
Type Traction
Location of Machine Penthouse
Motor Size 15 hp Phase 3 Volts 440
Generator Size (D.C.) Volts
Volts
Capacity 3500#
Car Switch
8' 1-" x 6' 9" - Floor Area
Cab Weight - 3200#
3500# Capacity
Machine No. 13820B
Controller No. Q 1252

ACCOUNT 3828 JOB Summary DEPT. X-509 YEAR 1956 BUDGET

JOB DESCRIPTION Maintenance of Elevators and Hoists

MONTH	BUDGET CURRENT MONTH	SPENT CURRENT MONTH	SPENT YEAR TO DATE	SPENT LAST YR. TO DATE	ACC. PERCENT COMPLETE	BUDGET REMARKS	EXPENDI
JAN.	946	1272	1272			Heavy Spread	Insurance Comp
FEB.	330	343	1615	945.63			Work Slips show
MAR.	1464						Metal Shop fabr

3828-21A
EQUIPMENT NO.
EQUIPMENT RECORD
DESCRIPTION 8' 10"/6' 7"/7' 10"
3,500 lbs. Speed 100 FPM
DRAWING NO.
MODEL OR TYPE
SERIAL NO.
CATALOGUE NO.
PROJECT NO.
MANUFACTURER Otis
PURCHASED FROM
PURCHASE ORDER NO.
DATE RECEIVED
DATE INSTALLED
SPECIFICATIONS

ELI LILLY AND COMPANY — INDIANAPOLIS, INDIANA
COST SUMMARY
DESCRIPTION 8' 10"/6' 7"/7' 10" Capacity 3,500 lbs. Inspected Bi-Monthly
ACCOUNT Elevator #21A DEPT. MACHINE NO. Lub. Monthly

DATE	MATERIAL	LABOR	TOTAL	DATE	MATERIAL	LABOR	TOTAL
	Inspection		416.24	1951	Repair		476.44
1951				1/52			62.64
				2/52			
	60.00	60.00		3/52	-----	71.40	71.40
	40.50	40.50		4/52	1.00	36.30	37.30
3/52				5/52		4.20	4.20
4/52	49.50	49.50		6/52		29.40	29.40
5/52				7/52	1.00	3.84	4.84
6/52				8/52		12.00	12.00
7/52	36.80	36.80		9/52		2.20	2.20
8/52				10/52		36.40	36.40
9/52				11/52			
10/52	35.60	35.60		12/52		26.70	26.70
11/52			222.40	1952	Total		224.44
12/52	Total			1/53			
1952				2/53			
1/53	20.70	20.70		3/53		18.40	18.40
2/53				4/53			
3/53				5/53			
4/53							
5/53							

These plant records are a practical guide to management in future repairs and purchases.

Good record-keeping helps
keep maintenance expenses down.
Here's how Eli Lilly Company proves that . . .

Planned maintenance saves dollars

JOHN WEBB, Assistant Director of Engineering
GEORGE ECKSTEIN, Maintenance Engineer
Eli Lilly Company

PREVENTIVE MAINTENANCE at Eli Lilly Company's Indianapolis plants reflects an emphasis on intelligent control of maintenance dollars. It obtains the coordinate benefits of planning future equipment purchases in light of documented past experience.

About 20 years ago, Eli Lilly adopted a system of preventive maintenance. There were several reasons for this plan — to establish a budget of maintenance expense, to establish an orderly approach to budget making. Lacking a history of maintenance expense, we were unable to forecast what our yearly costs should and would be. Equally important, we wanted to know that our maintenance efforts would be properly directed — that each maintenance check would be thorough, pre-planned. Thus major problems could be anticipated and breakdowns avoided. All these factors we considered essential to a sound plant-wide preventive maintenance program.

elevator maintenance proves plant-wide system

Although our system is plant-wide, this article is focused on but one phase by way of example — that applied to elevators and hoists in our Indianapolis plants. Over these past 20 years, we have developed a complete record system giving detailed information on the maintenance history of each elevator and hoist in the plant. These records are tabulated and kept in our engineering office.

First step in formulating our yearly maintenance program is to establish a budget for elevators and hoists. On the basis of past experience, our annual budget was set up:

McCarty Street Plant	Kentucky Avenue Plant
Amount $26,000	$10,000
No. of Hoists 52	32

We broke this down further into estimated monthly expenditures. A form is tabulated by the engineering department showing cumulative expenses for:

- Current month's budget,
- Amount actually spent during month,
- Cumulative monthly spending during year,
- How much was spent during corresponding month a year ago.

At a glance, the whole budget setup is shown with a quick comparison possible of previous year's expenditures.

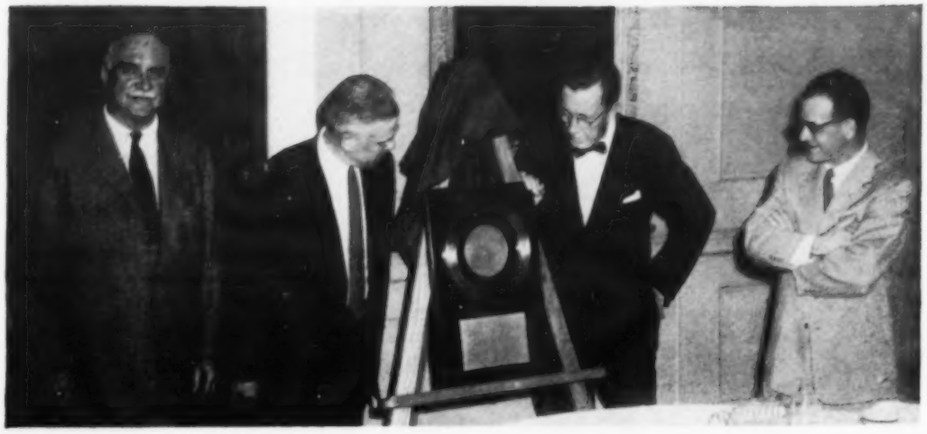
A master program of maintenance checks is also set up on a calendar basis, correlating recommended intervals for maintenance checks on each elevator and hoist. This program also sets up amount of time available in manpower to do the job. Master program assigns crews day by day throughout the entire year.

Maintenance continuity is developed by our own personnel doing maintenance jobs rather than employing an outside service. We

(continues on page 37)

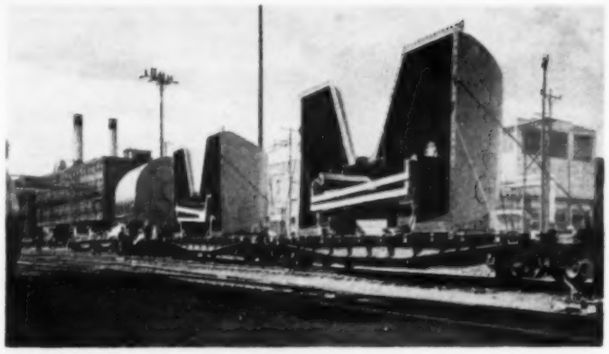
Maintenance personnel regulate elevator controls and note discrepancies during an inspection.

News in Photos

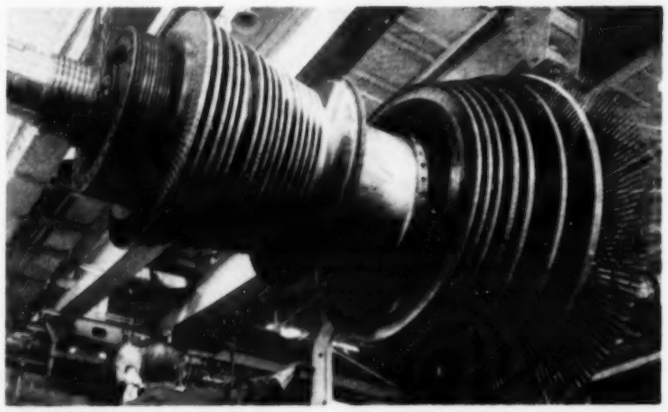


Engineer Gets Leadership Plaque. Dr. Frederick P. Fairchild, Chief Engineer, Public Service Electric and Gas Company of New Jersey, is presented plaque in recognition of his leadership as first to use austenitic steel in high-temperature, high-pressure power plant piping. Shown making presentation are, l. to r., Waldo McKee, The M. W. Kellogg Co.; Norman L. Mochel, Westinghouse Electric Corp.; Dr. Fairchild; and A. W. Rankin, General Electric Co.

Nuclear Graphite Goes to School. Here at Massachusetts Institute of Technology, graduate students of nuclear engineering study neutron behavior with no radiation hazards in atomic pile they constructed themselves. Dr. T. J. Thompson, professor of nuclear engineering at MIT, discusses the pile with students. Natural uranium in pile is activated by one of first plutonium-berylium neutron sources released by AEC.



World's Largest. Detroit Edison's River Rouge generating station is destination of these cars carrying components of world's first 300,000-kw steam turbogenerator unit. Built by Allis-Chalmers' West Allis works, unit on cars is one of the generator stators and sections of the low pressure exhaust casing.



Turbine Spindle for Shippingport. Because of its large size, this steam turbine spindle is being shipped in sections to atomic power station, Shippingport, Pa. When assembled, the 100,000-kw steam turbine will weigh 1,300,000 pounds, measure nearly 81-ft in length. Unit will be capable of handling steam at 1,400,000 lb/hr. Spindle and turbine were built by Westinghouse.

Small Welder for a Small Weld. To repair a damaged weld inside the reactor vessel in AEC-Duquesne Light Company's Shippingport atomic power station, a small welder was needed to enter the 15-inch opening. Eugene David, 40-inches tall and 60-pounds light, was imported from Augusta, Ga., by the Dravo Corp. to do the job. Photo at left, shows David entering the opening, assisted by another welder, Michael Velgos. Both men are dressed in white, lint-free clothing to insure that the entire area remains clean. Photo, right, shows David discussing his unusual assignment with Foreman Frank Wertz, Dravo Corp., and Lt. Cmdr. Donald Iselin, AEC project officer.

Survival

. . . starts on page 13

— with the technical advice and assistance on which his decisions affecting the power industry will be based. During this year's exercise, advice on power came mainly from representatives assigned to each Committee from the headquarters staff of Interior's emergency power organization. But we expect that in the near future, industry personnel, skilled in the operations of their areas, will be assigned to serve on these Regional Committees.

Already, the electric power industry can be proud of its fine contribution to the civil defense effort. In this year's Operation Alert, industry people helped civil defense directors on power supply questions at almost every civil defense office in the country — city, county, state, regional, national. Local utilities, working alone and together, solved many problems in the supply and transfer of energy. These utilities were assisted, as necessary, by power liaison personnel at city, state, and regional levels and by acting area directors.

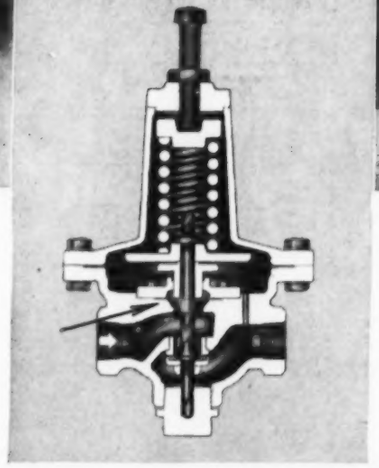
Although it is too early to make a comprehensive judgment on the exercise, based on all the reports we received, it is already apparent that much progress has been made since the 1956 alert. By playing a part in the exercise, utility officials have, I believe, gained a greater realization of the many problems that face the Government in its civil defense effort. Much remains to be done. But the experience that industry and Government both obtained in this year's Operation Alert should certainly help speed up our planning.

Through prudent planning we can minimize the destructive effects our generating capacity may suffer in an attack. Moreover, we can actually help to deter an attack, because planning increases our capacity to recover and retaliate after an initial onslaught.

Such advantages, however, demand the continuance and expansion of the fine teamwork which now exists between the power industry and the Government. ♦♦

Here is the new LESLIE "HI-FLO" Water Reducing Valve with 50% more capacity

It's Fully Balanced



Unique construction of "Hi-Flo" Reducing Valve. Note the small lower diaphragm that provides fully balanced, floating action.

HERE IS THE ALL NEW Leslie Reducing Valve with *capacity-regulation* features that have never been offered before. Here is a regulator with 50 - 100% greater capacity by actual test.*

Here's the unbeatable combination of design features:

"HI-FLO" — Large bowl construction; long stroke diaphragm gives full flow of water and other non-corrosive liquids.

FULLY BALANCED — The main valve, fully balanced by lower diaphragm, virtually floats to provide smooth, friction-free, throttling action.

DROP-TIGHT SHUTOFF — Resilient seating disc provides tight closure under all conditions.

TROUBLE-FREE DESIGN — Chatter and hammer eliminated; no piston cups or seals to clog or change. Corrosion resistant trim with renewable interchangeable fit.

Ask your Leslie Engineer to show you how the exclusive Leslie "Hi-Flo" valve can be used to your advantage in water reducing stations, fuel oil pressure control, process lines, etc. He's in your classified directory under "Valves" or "Regulators".

Write today for Bulletin 553 for graphic performance comparison and complete capacity data.

TRADE LESLIE MARK

REGULATORS AND CONTROLLERS

LESLIE CO., 263 GRANT AVENUE, LYNDHURST, NEW JERSEY

CONTROLLED QUALITY MEANS QUALITY CONTROLS

Circle 132 on READ-N-CIRCLE card for more data

By using carefully worked-out charts, showing recommended oils and greases for every application, here's how . . .

TABLE I

LUBRICANTS AND ALLIED PRODUCTS (COMPOUNDS)

PRODUCT	SYMBOL	SPEC & GRADE	RECOMMENDED USE
Compound, Exterior Surface Hard Film Corrosion Preventive	CPH	GRADE I MIL-C-16173	For protection of metals exposed to weather.
Compound, Soft-film Corrosion Preventive	CPS	GRADE II MIL-C-16173	For extended undercover protection of interior or exterior surfaces of machinery, instruments, bearings, or material with or without the use of supplementary barrier materials.
Compound, Water Displacing film corrosion preventive		GRADE III MIL-C-16173	For use where water, saline solution, must be displaced from corrodible surfaces and the corrosion prevented or arrested. For protection of interior surfaces of machinery, instruments or material under cover for limited periods.
Corrosion preventative Oil, Gas Turbine Aircraft	CCP	MIL-C-8188	Corrosion preventive oil for preserving engines normally operating on Specification MIL-L-7808 synthetic lubricating oil. Use as required by Specifications MIL-E-5595, MIL-E-5607.
Compound, Insulating & Sealing Electric Connections	CIS	MIL-I-8660	For sealing electrical joints of engines and in sealing and insulating electric equipment.
Anti-seize Compound, White Lead Base (General purpose threaded fittings)		JAN-A-669	General purpose anti-seize and sealing compound for threaded parts and mating parts. Composed of mixture of graphite, white lead, petrolatum, linseed oil, and mineral oil, has paste-like consistency. Do not use on spark plugs, oxygen, or hydraulic lines.
Compound, Anti-seize Graphite Petroleum	GSP	MIL-T-5544	Anti-seize compound primarily for spark-plug threads. Also suitable for other high temperatures to 1,200 F, such as stainless steel bolts on engine mountings.
Compound, Corrosion Preventative Aircraft Engine Heavy Oil Type	CEH	MIL-C-5545	For internal parts and surfaces of engines and equipment for the prevention of damage by corrosion. Employed for static preservation only, and is removed from engine prior to use.
Corrosion Preventative Lubricating Oil, Aircraft Engine	CEN	MIL-C-6529	Corrosion preventives, engine preservatives for engines operating on mineral base oils. Should be used as required by Spec. MIL-E-6058, MIL-E-5595, and MIL-E-5607.

TABLE II

LUBRICANTS AND ALLIED PRODUCTS (LUBRICATING OILS)

PRODUCT	SYMBOL	SPEC & GRADE	RECOMMENDED USE
Lubricant, Gear Universal	GO	MIL-L-2105	Grades 75, 80, and 90 for gear boxes where better load-carrying properties than Specification MIL-O-6086 oil required.
Oil, Lubricating Jet Engine	OJE	MIL-O-6081	Grades 1005 and 1010 for lubrication of jet engines. Also for general use where good, low-temperature properties required and rust inhibition not needed.
Lubricating Oil, Aircraft Engine	OEA	MIL-L-6082	Grades 1065 and 1100 for reciprocating engines. Also used where heavier grades are required for general lubrication when low-temperature characteristics need not be considered.
Lubricating Oil, Aircraft Instruments	OAI	MIL-L-6085	Low-temperature oil, containing a special synthetic oil component, inhibited against oxidation, and possessing rust-preventive properties for instruments and electronic equipment.
Gear Oil, Low Temperature	OGR	MIL-O-6086 GRADE L GRADE M	For gear boxes where extreme pressure properties required. Major uses in heavy-duty gear boxes and constant speed alternator drives.
Lubricating Oil, Synthetic Base	OSB	MIL-L-6387	Synthetic oil with additives to impart oxidation stability, improve viscosity-temperature characteristics, and improve anti-wear properties. For constant speed alternator drives, air compressors, expansion turbines.
Lubricating Oil, Gas Turbine		MIL-L-7808	For gas turbine engines (EEL oil).
Lubricating Oil, General Purpose Low Temperature	OGP	MIL-L-7870	For general squirt-can lubrication. Suitable where a very light, low-temperature, corrosion-preventive lubricant is required.
Lubricating Oil, General Purpose		MIL-L-15016	Grades 2110 (SAE 10) and 3050 (SAE 20) for slushing tanks only.

TABLE III

LUBRICANTS AND ALLIED PRODUCTS (HYDRAULIC FLUIDS)

PRODUCT	SYMBOL	SPEC AND GRADE	RECOMMENDED USE
Oil, Hydraulic Aircraft Petroleum Base	OHA	MIL-O-5606	Primarily developed as an operating oil for hydraulic systems and shock systems. Also for some self-contained hydraulic mechanisms.
Oil, Preservative, Hydraulic	OBC	MIL-O-6083	Essentially a Specification MIL-O-5606 oil with rust-preventive additive. For preservation of hydraulic systems in storage and shipment, and as testing and preservative oil for hydraulic components.

TABLE IV

LUBRICANTS AND ALLIED PRODUCTS (LUBRICATING GREASES)

PRODUCT	SYMBOL	SPEC & GRADE	RECOMMENDED USE
Lubricating Grease, Gas & Oil Resistant	GRG	MIL-L-6032	Fuel selector valves and oil resistant gaskets. (Non Petroleum Product)
Graphite, Lubricating	FG	MIL-G-6711	200-mesh, high-grade, powdered graphite for use either as a dry lubricant or mixed with a suitable proven specification oil.
Grease, Aircraft Gear & Actuator Screw, High & Low Temp.	GSG	MIL-G-7118	Synthetic grease for general use on gears, actuator screws, and other equipment where better load carrying capacity than Specification MIL-G-3278 is required. -65 F may increase torque several times.
Grease, Graphite Aircraft	GG	MIL-G-7187	For starter gears and similar applications where frequent lubrication is not possible, for the lubrication of plain bearings. Not suitable for ball or roller bearings, electric equipment, or extreme low- or high-temperature operation.
Grease, Extreme Low Temperature		MIL-G-7421	For anti-friction bearings, gears, rolling and sliding surfaces of equipment having very low motivating power, some types of electronic equipment, instruments, and very small actuators where starts at -70 F, or lower, may be required.
General Purpose Grease	GB	MIL-L-7711	Use restricted to applications where Specification MIL-G-3278 grease not satisfactory.
Grease: Aircraft and Instruments (for low & high temp.)	GST	MIL-G-3278	Ball and roller bearings - plain bearings, instruments, accessory drives, actuator screw jacks and gears. Does not contain e.p. additives, for lightly-loaded applications.
Lubricating Grease, High Temperature	GH	MIL-L-3545	Anti-friction bearings for high speeds and high temperatures or for long retention and water resistance. For lubrication of engine accessories.
Grease, Pneumatic System	GPS	MIL-G-4343	For pneumatic systems between rubber seals and metal parts (under dynamic conditions). It may be used at pressures up to 2,000 psi Buna N or MIL-P-5516 rubber.
Lubricant, Molybdenum Disulphide		MIL-L-7866	Dry lubricant or mixed with suitable specification oil or grease for special applications. For thread anti-seize, for light loaded applications where wet lubricant objectionable.
Dry Film Lubricant			Moly disulphide MIL-L-7866 in a resin binder.

Convair solves its lubrication problems

CHARLES HIBERT, Senior Engineer
Convair, a division of General Dynamics Corporation

Technological advances in lubrication have given Power Services engineers lubricants with exceptional properties. New products are not, however, a cure-all. Judgment in selection and use still play an important role. Keep abreast of modern practices by reading how Convair selects and uses modern lubricants to obtain best results with minimum cost.

PROPER LUBRICATION of engines, motors and other standard industrial equipment can be no problem at all — *if* manufacturers' recommendations are carefully followed. But it *can* be a major headache in operating non-standard, specialized machinery — primarily because personnel with lubrication engineering experience are hard to get.

We do not intend to imply that we have a cure-all for every industrial lubrication problem, but we believe that the basic lubrication concepts we have developed at Convair can alleviate a great many troublesome industrial lubrication headaches.

These concepts, illustrated by the accompanying tables, were developed and are employed by Convair to facilitate lubrication where necessary, to minimize friction wear, to increase safety and ease of operation, and to prevent corrosion of expensive machined parts.

By lubricants, we mean oils and greases. We use oils where rotational speeds exceed 10,000 rpm because of the many application methods available. At high speeds where churning and accompanying heat or power loss occurs, small amounts of oil can be fed to bearings by oil rings and slingers, metering plugs, wick-feeds, oil mist, or drip feed. Oil circulating systems are preferred where plain and antifriction bearings are operated at high ambient temperatures under severe loads.

Oils are classified as general purpose, gear, and hydraulic fluids. Two oils have been developed for general lubricating purposes. One (Government Specification Number MIL-L-644), is basically a rust inhibitor for bare steel. The other (MIL-L-7870), is used to reduce friction. Key properties of lubricating oils used by Convair are shown in Table V on this page.

Light and medium grades (MIL-0-6086) are our most commonly used gear oils. These must remain fluid at low temperatures to minimize starting torque in accessory boxes, yet maintain protective films on gear teeth at high temperatures. Gear oils must have extreme-pressure agents for providing high load-carrying capacities.

Light and medium types of petroleum-base hydraulic fluids (MIL-0-5606) are generally used in our hydraulic systems. We have found all the nonflammable fluids deficient for our uses. Tables II and III give oil lubrication specifications and recommended uses.

Greases used in lubrication at Convair are divided into four general classifications. (Key properties of lubricating grease are shown in Table VI.) These (together with Government Specification Number) are:

General Purpose	MIL-G-3278
Low Temperature	MIL-G-7421
High Temperature	MIL-L-3545

(continues on page 38)

TABLE V
KEY PROPERTIES OF LUBRICATING OILS

SPEC REQUIREMENTS	MIL-O-6086		MIL-L-6082		MIL-L-6387 GEAR	MIL-L-7808	MIL-C-6529	MIL-C-6158 GEAR	MIL-L-7870	* MIL-L-6082	* MIL-O-5606	MIL-O-6081		MIL-L-6082
	L	M	1065	1100								1010	1005	
VISCOSITY INDEX MIN	80	80	100	95			95							
VISCOSITY SECS AT 210 F			62-68	93-103			110							
VISCOSITY CENTISTOKES AT 210 F MIN 130 F MIN 100 F MIN -40 F MAX -65 F MAX	23-34	60-82			4.5 10.0 1500 7500	11.0 13000		11.0 18000	10 4000	10 800	10 500	10 3000	5 2600	0 2000
FLASH POINT MIN	280 F	310 F	420 F	970 F	350 F	385 F	400 F	300 F	265 F	200 F	200 F	270 F	225 F	365 F
POUR POINT MAX	-40 F	-20 F	0 F	10 F	-75 F	-75 F	10 F	-75 F	-70 F	-75 F	-75 F	-70 F		-70 F
HUMIDITY CABINET							336	144	100	100				100

* HYDRAULIC FLUIDS NOT NORMALLY USED FOR LUBRICATION OF PARTS OTHER THAN HYDRAULIC INTERNAL SYSTEM.

TABLE VI
KEY PROPERTIES OF LUBRICATING GREASES

SPEC REQUIREMENTS	MIL-G-3278	MIL-L-3545	MIL-G-4343	MIL-G-7118	MIL-G-7421	MIL-L-7711
PENETRATION (WORKED 77 F)	260-310		260-300	310-385	260-330	285-340
DROPPING POINT, MIN	325 F	350 F	325 F	325 F	325 F	300 F
APPARENT VISCOSITY AT -65 F (1) POISES (20 SECONDS MAX)	10,000		5,000	15,000	(AT -100 F) (15,000)	
LOW TEMPERATURE TORQUE TEMPERATURE TORQUE [DR - CM]	-65 F 2000			-65 F 2000	-100 F 2000	-40 F 2000
SECONDS FOR 1 REVOLUTION	5			5	5	10
HIGH-TEMPERATURE PERFORMANCE TEST BEARING AT 10,000 RPM TEMPERATURE	1000 HRS 250 F	600 HRS 300 F		1000 HRS 250 F	600 HRS 300 F	1000 HRS 300 F

POWER BASICS FOR TODAY'S INDUSTRY

Fluid mechanics - - I

Fundamentals and definitions

To many engineers, fluid mechanics is a subject surrounded by strings of incomprehensible formulas that defy interpretation except by long-haired devotees. These people seem to delight in disconcerting everyone outside their own field. This series will clarify the subject for those who have been out of touch for some time. If it helps to reduce lost motion or prevent cavitation in the pipeline to the front office, then it will have served its purpose.

PROFESSOR JAMES M. ROBERTSON
Theoretical and Applied Mechanics
University of Illinois

James M. Robertson, a native of Illinois was graduated from University of Illinois with a B.S. in 1938, and from State University of Iowa with advanced degrees in 1941. He conducted hydrodynamics research in regard to ships at the Navy's David Taylor model basin until 1942. For five years, he was in charge of water tunnel-underwater ballistics research for the Navy's Bureau of Ordnance. Professor Robertson's special interests are cavitation, turbulent boundary layers, hydroacoustics, and hydroballistics.

A FLUID MECHANICS study involves two considerations: applying the basic laws of mechanics to the analysis and prediction of motion of fluid bodies or systems, and understanding the phenomena involved in the behavior of moving fluids. Because fluid motion can be complex, some flow situations can be handled only with the aid of empirical information. In such instances, dimensional analysis and similarity considerations help describe phenomena in the most general terms.

Mechanics is concerned with the laws of motion as they pertain to particles, rigid bodies, elastic and plastic bodies (as in studying resistance of materials), and fluid bodies. From a gross physical sense we know that matter may appear in the solid, liquid, or gaseous phase, depending upon ambient temperature and pressure. We are all familiar with the chemical compound H_2O in the form of ice, water, and steam. From a molecular standpoint, these three phases represent different levels of molecular activity or mobility. We can define a fluid as a substance that *cannot* support a tangential or shearing force without motion (Fig. 1). This definition distinguishes fluids from solids, which *can* maintain a shearing stress by deforming but not flowing.

Our definition of fluids includes both the liquid and gaseous phases in which substances may occur. From the fluid mechanics standpoint, liquids and gases differ only in their compressibility and in the fact that liquids form a free surface (Fig. 2). Our concern here is primarily with the incompressible flow of fluids at velocities less than a few hundred feet per second. At such low speeds, it is easily shown that the effects of compressibility in gases are negligible. Since liquids are compressible, but much less so than gases, velocities as high as a thousand feet per second may be considered without concern for compressibility.

density and viscosity are important

In the study of fluid motion, the behavior of different substances is characterized with the aid of certain properties. For incompressible fluid mechanics, the two principal properties are density and viscosity. From a physical standpoint, *density* is defined as the quantity of matter (mass) occupying a unit volume of space. In the foot, pound (weight), second system, the unit of mass is derived by dividing the unit of weight by the gravitational constant g. Thus, mass is measured in slugs or lb sec_2/ft and the unit of density ρ (rho) is measured in slug/ft^3 or lb sec^2/ft^4. Since specific weight, symbolized by γ (gamma), is defined as weight per unit volume, we can write

$$\gamma = \rho g \qquad (1)$$

Another convenient term often used to characterize liquid density is *specific gravity* S. This is defined as the ratio of the mass of volume of a fluid to the mass of an equal volume of water under standard conditions.

$$S = \frac{\rho}{\rho_{H_2O}} = \frac{\gamma}{\gamma_{H_2O}} \qquad (2)$$

Values of S for a few common liquids are indicated in Fig. 3.

Viscosity is a measure of resistance to motion (as in shear) of adjacent layers of a material. We have already noted that a fluid differs from a solid in that it deforms continuously when subjected to shearing stresses. All real fluids tend to resist this sliding motion or deformation in proportion to their viscosity. Viscosity is defined in accordance with Newton's original postulate as the proportionality factor in the relation for shearing stress

$$\tau = \frac{F}{A} = \mu \frac{V}{Y} \qquad (3)$$

Thus, in Fig. 4, the tangential force F that must be applied to area A to maintain the motion of one plate parallel to another varies directly with the area and velocity, and inversely with the spacing of the plates Y.
or, for cases when velocity varies with y

$$\tau = \mu \frac{du}{dy} \qquad (3a)$$

Symbol μ (mu) represents viscosity or coefficient of viscosity and is measured in lb sec/ft^2.

Viscosity often appears in a form such that it must be divided by density. The ratio $\mu/\rho = \nu$ (nu) is termed *kinematic viscosity*, and is measured in ft^2/sec. Since these units are much more tractable than those for μ, use of kinematic viscosity is preferable.

Be warned, however, that all substances that appear to be fluids do not obey Eq. 3. Those which don't, such as plastics and inverted plastics, are called non-Newtonian fluids. In addition, some pure

liquids suspensions and gels behave this way. In such cases, μ is not a constant for the fluid but is a function of shear stress.

We should also take a brief look at some other properties of liquids—compressibility, surface tension, and tensile strength. We know that gases are more compressible than liquids and that they are more apt to flow at velocities where compressibility must be considered. But we must consider thermodynamics too, bringing ourselves into the fringe area of gas dynamics. Compressibility also must be considered in acoustics (with air or water as the medium) and water hammer.

Surface tension requires an interface and hence is considered a liquid property. It affects such phenomena as capillarity, formation of ripples or waves, and atomization of liquid sprays into fine droplets.

Tensile strength or cohesion of a liquid is closely related to vapor pressure. Everyday observations suggest that liquids have no tensile strength. If we have a pure liquid, however, or if we apply the tension quickly, we find that liquids do have tensile strength. Generally, liquids cannot withstand tension and will boil whenever pressure at a point reaches the local value of vapor pressure. Boiling or vaporizing that results from pressure reduction due to flow is called cavitation — a common bogey that causes reduced efficiency, vibration, and noise. If serious enough, cavitation will even cause erosion.

when to use Bernoulli's Theorem

Applying the principles of mechanics to analysis of flowing fluids is most often achieved by using Bernoulli's Theorem. This is the keystone of fluid mechanics and hardly a problem is solved without its aid. Bernoulli's theorem is derived from the first law of thermodynamics (conservation of energy) or the Euler equation of motion for a fluid particle, under certain assumptions or approximations. From an energy standpoint, ignoring chemical and nuclear energies, we equate energy at the beginning of some flow process to that at the end. This must be modified for heat added and work done on the system. Using

(continues on page 40)

seatless means savings

For nearly 50 years boiler plants in low and medium pressure ranges have been saving maintenance time and down-time thanks to dependable, trouble-free blow-down service from Yarway Seatless Blow-Off Valves.

The reason is simple. One of the commonest sources of blow-off valve trouble is eliminated. *There is no seat to score, wear, clog or leak.*

Over 16,000 plants depend on YARWAY SEATLESS.

Yarway Seatless Blow-Off Valves feature the famous balanced, sliding, hollow plunger design that permits free and easy operation—full, unobstructed flow. Cut-away picture shows Type B angle valve with plunger in open position. Plunger, glands and packing rings also shown separately. Yarway Seatless Valves are available in angle and straightway types, in four tandem combinations.

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It's up to you to foresee
the effects of nuclear attack on your plant,
where life or death will hinge on your . . . .

Fast rescue operations

Only by having adequate rescue equipment available before disaster strikes can rescue crews do the most efficient job. Remember that decisions will have to come fast, so try to anticipate all situations now. Walk around your plant, and imagine the havoc that would be caused if it only suffered blast damage.

It will often be necessary to raise heavy beams and debris quickly in order to gain entrance to disaster victims. Here, a 10-ton Porto-Power with chains and pull-plate attachment gently raises warped steel sections in damaged plant. These hydraulic rescue sets, available in 4-, 10-, and 20-ton capacities are manufactured by Blackhawk Manufacturing Co., Milwaukee, Wis. Sets range in weight from 48 to 244 pounds, are designed for portability, and easy assembly into many combinations on the spot.

Extricating victims is only half the story. Quite often, most immediate job will be to brace shaky walls and hold debris in place so that other rescue operations can continue. Units can be left in place until plant walls are rebuilt or repaired.

Structural steel, crushed in explosion, is lifted with hydraulic unit. Rescue workers can pin-point tool close to victim, yet control force from a safe distance. There is no danger of accidental lowering. Unit meets specifications for Civil Defense item VIII-156. It can push, pull, spread, lift, clamp, and press.

No outside source of power is required with hydraulic ram units. A force of four tons is produced by forty-two pounds pressure on the hand pump. Ram works in any position—an important factor in rescue operations. Is your plant prepared for nuclear attack? Are you ready?

Keeping pace with modern trends,
here is some original thinking
that offers . . .

a solution to fan blade erosion

DR. A. LEIBKNECHT
Director of Research
University of Bathurst, N.S.W.

IN RECENT YEARS, need for a dependable method of designing efficient shapes for conoidal fan blades that will reduce the eroding effects of today's fuels and maintain or improve fan efficiencies has been evident.

The overloading characteristics of forward-curved blades and material shortages that prevented application of the more advanced paranastic shims to reeving sockets and nivel-type hub sheaves delayed earlier attempts at unit compactness. Most of these attempts involved smaller wheel diameters and a diminished wennel sprocket to grouting sheet ratio. (See *"Fans"* by R. D. Inges, Barber-Heath, London, 1938.)

Basically, the parametric boloid slot is not a new idea. Satisfactory results with it were limited until the advent of a more simply constructed marzelvane that eliminated angular creepage at the "held end" of the roffit bar coupling. This, of course, was impossible to achieve without adequate nangling pin resistance to the shearing effect caused by side-flowing eddy gusts that occured at higher rpm.

A far more economical solution to this problem has been found by "beefing up" the lingle struts, particularly at their conflux directly over the wennel sprocket housing. This has the dual effect of reducing iambic stresses and leaving a cleared field for the rotating pentameter grid housing.

The parametric boloid slot allows lighter construction throughout, without the drawbacks inherent in lighter nubbing spoke and hub construction. Application limits may be written as:

$$RV = \frac{(R_o - r_1)\ K}{r}$$

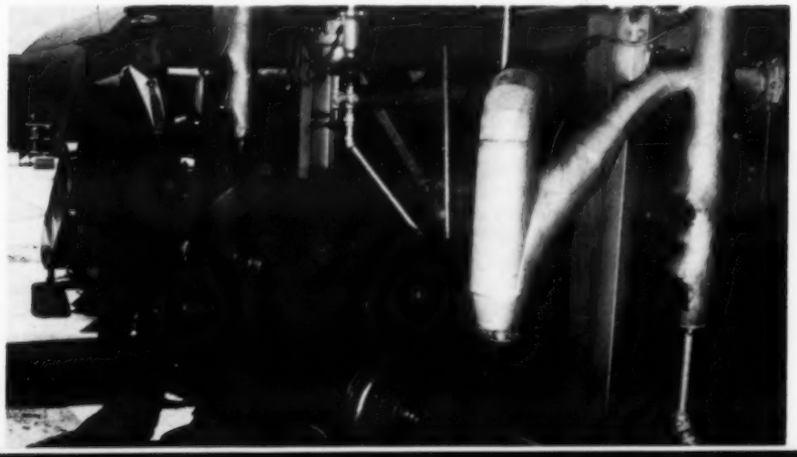
(r in radians)

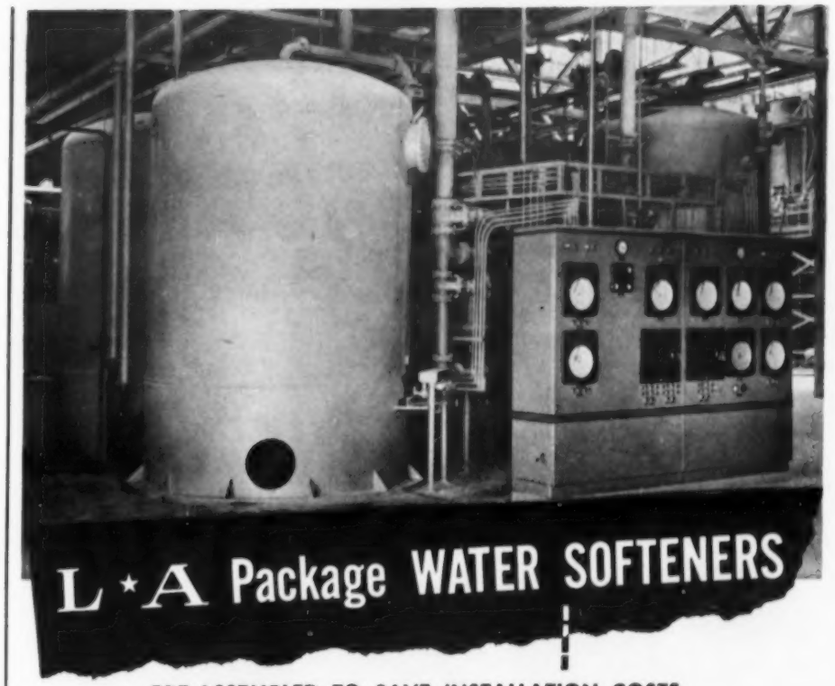
It must be understood that the Reltering Velocity referred to above is the new standard value arrived at by Wheatley's method, and K is Inges' periodic peltering coefficient (applicable only at higher speeds).

Along the purely theoretical line, it has been found through further research that a direct relationship exists between embivelic torque ratios and purwinders as they both relate pentameter readings in a not too-direct manner (in the inverse sense). In practice, however, this relationship is not overly useful.

Undoubtedly, as fuel costs ascend and commercial grades become more inferior, we shall see a general trend favoring use of the parametric boloid slot. It is a useful device that may be employed to increase fan efficiencies without materially increasing unit cost. ♦ ♦

Dr. Leibknecht was for many years associate professor of Theoretical Tetro-Tractic Hypothetics at Mannheim Institute in Umlaut. He was later appointed Director of Research for the Australian Marsupial Association in Goondiwindi.





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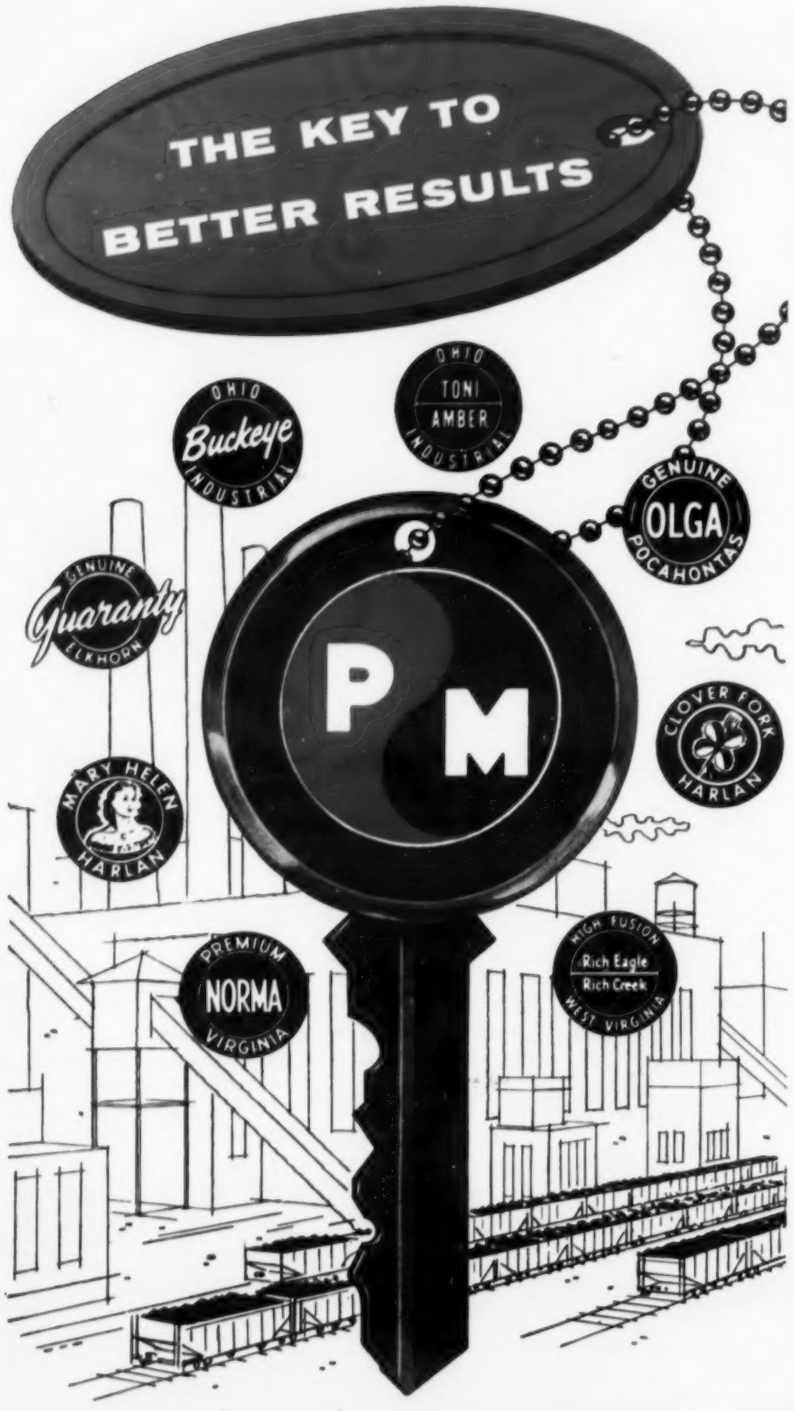

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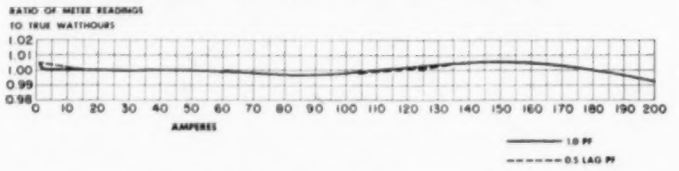
IP new products

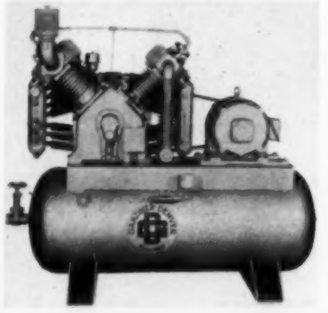
700-Single-phase watthour meter gives on-line accuracy to 200 amps



Stator in I-60 single-phase watthour meter has pair of magnetically isolated electromagnets, one for voltage and one for current, to give on-line accuracy up to 200 amps. New stator design eliminates former meter troublespots, including potential losses, torque reductions, coil balance errors at heavy loads and a low power factor. Butyl-insulated current coils move freely on current laminations without affecting meter calibration, eliminating calibration errors from gap distortion caused by socket forces transmitted through current leads. Design features include magnetic suspension of rotor to eliminate bearing maintenance; corrosion-resistant parts; retarding magnets die-cast into frame; one-piece molded base; butyl-molded potential coils; lightning surge relief gaps. Starting watts average about 22 with potential coil watts loss of 1.1. Meter torque is 40 gm mm. GENERAL ELECTRIC CO.

701-Extra-capacity air compressor

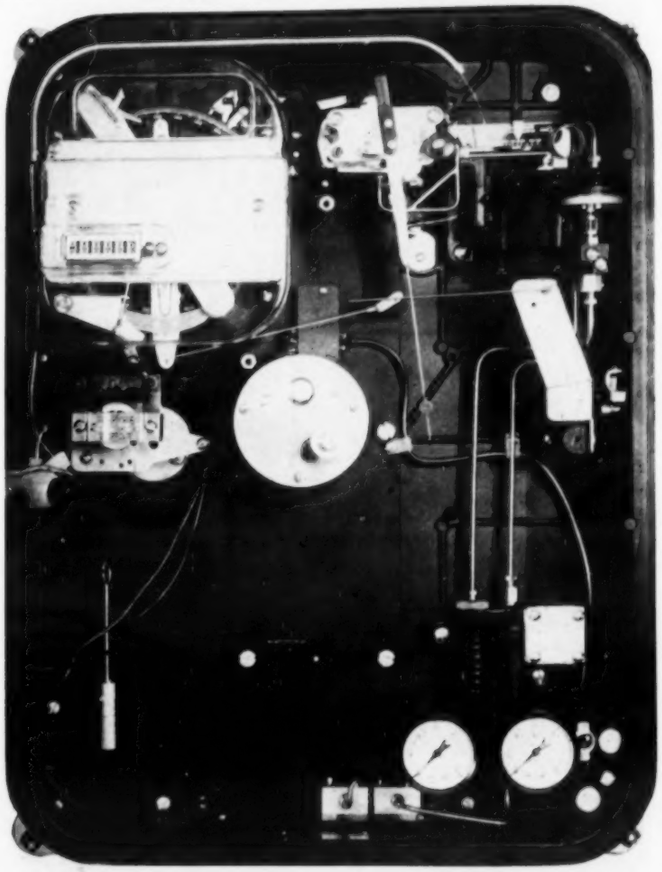
ADL-1000 is two-stage, air-cooled, 20-hp, two-cylinder vertical air compressor. In continuous service, compressor has piston displacement of 100 cfm at 870 rpm, discharge pressure to 150 psi. On intermittent service, compressor gives discharge pressure to 250 psi. Excellent for standby or peak load service. GARDNER-DENVER CO.



702-Liquid-cooled power junction

Liquid-cooled germanium power junctions rated at 670 amps rectified dc are designed for heavy power conversion. Six types are available in range of 20 to 66 volts rms. Junction is 5 by 3 7/8 by 3 3/8 inches. Copper housing is cast around special alloy steel tubing. Recirculating cooling medium over 52-sq in. internal cooling area permits handling heavy, continuous industrial loads. Water, oil, or other accepted coolants may be used. Rectifier equipment power consumption is lowered, efficiency stepped up through compact, lightweight junction design. Connected in a three-phase bridge circuit, six junctions will deliver 170 kw (2000 amps at 85 volts.) INTERNATIONAL RECTIFIER CORP.

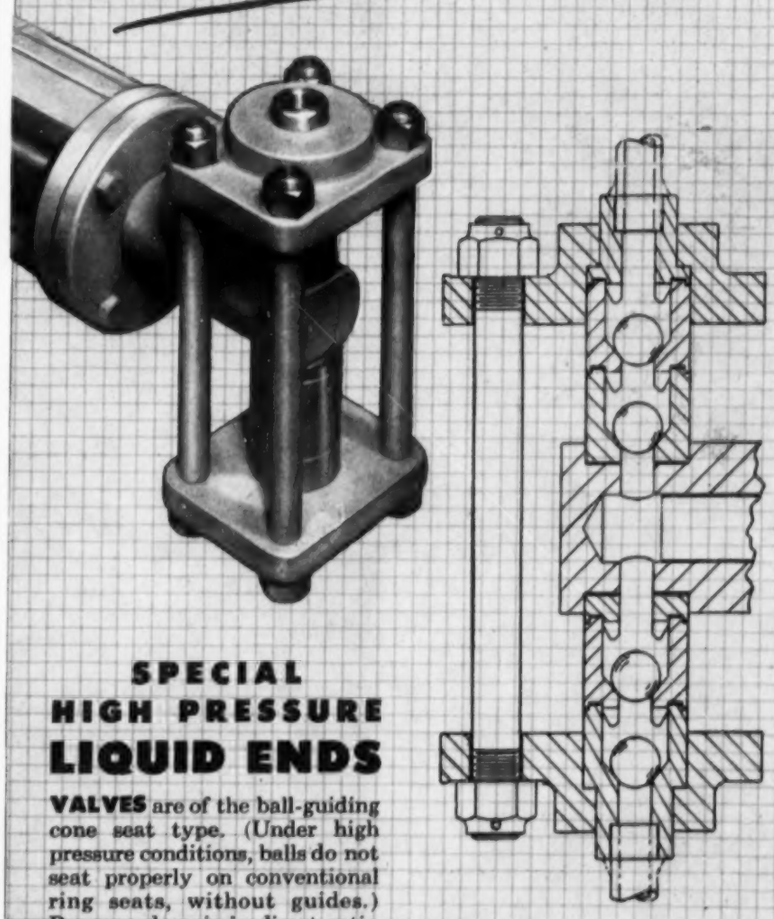
703-No working parts touch measured fluid



Ring balance meter uses a hollow ring fitted with a baffle at top and partly filled with a heavy fluid as actuating element. Differential pressures admitted through flexible S tubes on opposite sides of baffle cause ring to rotate on its axis, actuating pen mechanism. S tubes eliminate static pressure effect. No. working parts contact measured fluid, stuffing boxes are eliminated. Suitable for recording, indicating, and controlling process variables involving different heads, flow, absolute pressures to 20 psia, liquid specific gravity. Instrument accuracy is ± 0.5% of full-scale range down to 10% of scale. Pneumatic and electric transmitters optional for remote service. HAGAN CHEMICALS & CONTROLS, INC.

(continues on page 28)

advanced design in high pressure pumps



SPECIAL HIGH PRESSURE LIQUID ENDS

VALVES are of the ball-guiding cone seat type. (Under high pressure conditions, balls do not seat properly on conventional ring seats, without guides.) Pressure drop is in direct ratio to ball rise. Valves are machined from solid stainless steel bar. Balls are hardened and ground stainless steel. They may be spring-loaded for down-stream pumping and viscous materials (up to 30,000 SSU).

HEADS are forgings or castings, depending upon size.

PISTONS are highly polished stainless steel or ceramic, ground and polished, as required.

PACKING is contained in the gland, *not divided*. Gland take-up is a screwed nut rather than a lantern flange, insuring even pressure on packing—*no cocking*.

Write for Bulletin HP-1254.

PHILADELPHIA PUMP DIVISION OF AMERICAN METER CO.

13500 Philmont Avenue, Philadelphia 16, Pa.

PHILADELPHIA SERIES HP HIGH PRESSURE PUMPS

Circle 117 on READ-N-CIRCLE card for more data

Where Do Great Ideas Come From?

From its beginnings this nation has been guided by great ideas.

The men who hammered out the Constitution and the Bill of Rights were thinkers—men of vision—the best educated men of their day. And every major advance in our civilization since that time has come from minds *equipped by education* to create great ideas and put them into action.

So, at the very core of our progress is the college classroom. It is there that the imagination of young men and women gains the intellectual discipline that turns it to useful thinking. It is there that the great ideas of the future will be born.

That is why the present tasks of our colleges and universities are of vital concern to *every* American. These institutions are doing their utmost to raise their teaching standards, to meet the steadily rising pressure for enrollment, and provide the healthy educational climate in which great ideas may flourish.

They need the help of all who love freedom, all who hope for continued progress in science, in statesmanship, in the better things of life. And they need it *now!*

If you want to know what the college crisis means to you, write for a free booklet to: HIGHER EDUCATION, Box 36, Times Square Station, New York 36, N.Y.

HIGHER EDUCATION
KEEP IT BRIGHT

PUBLIC SERVICE ADVERTISING COUNCIL

Sponsored as a public service, in cooperation with the Council for Financial Aid to Education

IP new products

. . . starts on page 26

704-Fractional hp motors have new ratings

Model R re-rated fractional horsepower motors in NEMA frame sizes 56 and 48 are available in ratings from 1/8 to 1 hp in polyphase, capacitor single-

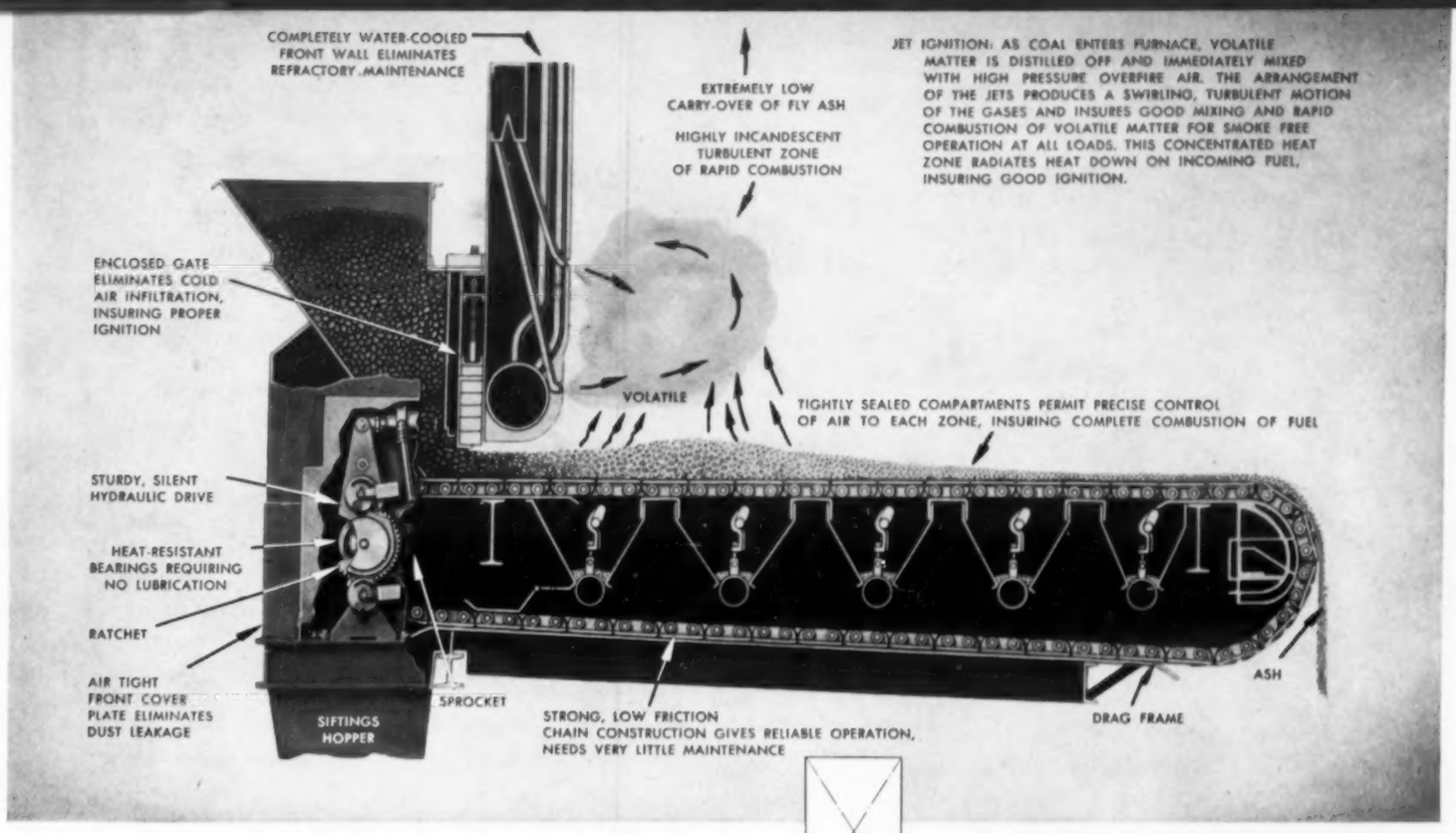
phase, permanent split capacitor, and split-phase types. Either totally enclosed fan-cooled or totally enclosed non-ventilated construction available. Aluminum replaces certain parts formerly of cast iron to cut motor weights as much as 50% in some models. Optional re-lubrication system available for models with sealed ball bearings. Mylar polyester film is used for slot cell insulation. ROBBINS & MYERS, INC.

705-Cut noise from machine vibration

Shear-Flex machinery mounting pads of oil-resistant Neoprene deflect throughout full load range of 5 to 70 lb/sq/-

in. Raised ribs provide skid-proof surface. For extra heavy loads, Shear-Flex is used in layers with ribs crossing at right angles. Shear-Flex is cut to size with scissors or knife, then placed under machinery. No bolting or cementing needed. VIBRATION MOUNTINGS, INC.

(continues on page 30)


COMPLETELY WATER-COOLED FRONT WALL ELIMINATES REFRACTORY MAINTENANCE
EXTREMELY LOW CARRY-OVER OF FLY ASH
HIGHLY INCANDESCENT TURBULENT ZONE OF RAPID COMBUSTION
JET IGNITION: AS COAL ENTERS FURNACE, VOLATILE MATTER IS DISTILLED OFF AND IMMEDIATELY MIXED WITH HIGH PRESSURE OVERFIRE AIR. THE ARRANGEMENT OF THE JETS PRODUCES A SWIRLING, TURBULENT MOTION OF THE GASES AND INSURES GOOD MIXING AND RAPID COMBUSTION OF VOLATILE MATTER FOR SMOKE FREE OPERATION AT ALL LOADS. THIS CONCENTRATED HEAT ZONE RADIATES HEAT DOWN ON INCOMING FUEL, INSURING GOOD IGNITION.
ENCLOSED GATE ELIMINATES COLD AIR INFILTRATION, INSURING PROPER IGNITION
VOLATILE
TIGHTLY SEALED COMPARTMENTS PERMIT PRECISE CONTROL OF AIR TO EACH ZONE, INSURING COMPLETE COMBUSTION OF FUEL
STURDY, SILENT HYDRAULIC DRIVE
HEAT-RESISTANT BEARINGS REQUIRING NO LUBRICATION
RATCHET
AIR TIGHT FRONT COVER PLATE ELIMINATES DUST LEAKAGE
SIFTINGS HOPPER
SPROCKET
STRONG, LOW FRICTION CHAIN CONSTRUCTION GIVES RELIABLE OPERATION, NEEDS VERY LITTLE MAINTENANCE
DRAG FRAME
ASH

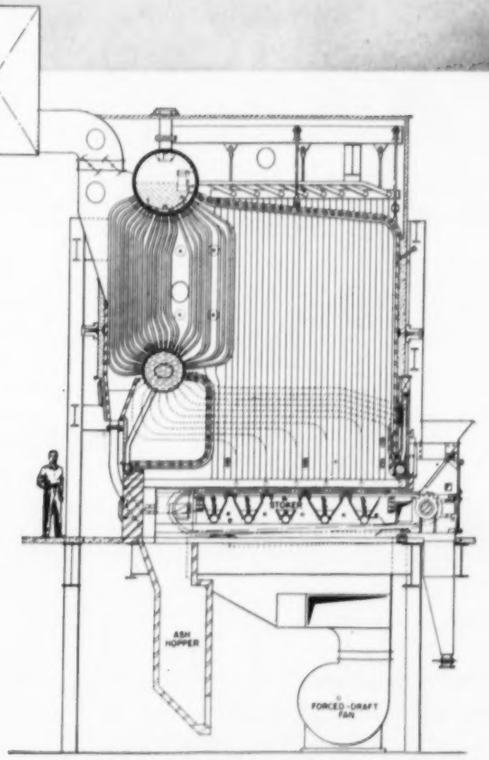
Latest Unit at University of Rochester Will Burn High-Caking Coals

B&W JET-IGNITION STOKER SELECTED TO SOLVE SMOKE AND FLY ASH PROBLEMS

Stable, efficient combustion over wide load ranges, without smoke and with extremely low fly ash, is achieved by the new B&W Jet-Ignition Stoker when burning bituminous and sub-bituminous coals—including high-caking and coking grades. The Jet-Ignition Stoker maintains a clean stack without using dust collectors.

Selection of a B&W Jet-Ignition Stoker for the University of Rochester was made to solve a community relations problem caused by smoke and fly ash. Dr. Lewis D. Conta, Chairman of the University's Division of Engineering, and George D. Haas, Chief Engineer, recommended installation of the unit after observing a commercial installation burning the high-caking coals used by the University.

B&W Jet-Ignition Stokers are another of the developments of B&W engineering and research, supported by nearly a century of experience in all phases of steam generation. If your problem is one of excessive smoking and fly ash emission, Bulletin G-85 will tell you how a B&W Jet-Ignition Stoker can help you. And for any problem in steam generation, B&W engineers are ready to help you and your engineers find the solution. The Babcock & Wilcox Company, Boiler Division, 161 East 42nd Street, New York 17, N. Y.



B&W Stirling Boiler with Jet-Ignition Stoker at University of Rochester, designed for 100,000 lb of steam per hr at 125 psi.

G-831-1B

BABCOCK & WILCOX

BOILER DIVISION

Circle 129 on READ-N-CIRCLE card for more data

What good is specialized business publication advertising?

Frank Kistenberger
Metallizing Engineering Co., Inc.

Sells industry

No one is in a better position to give a hard-boiled, practical answer to this question than the men who spend their working lives on the sales front . . . the men the ads are supposed to help . . . the men who sell.

Here is the statement of a salesman who knows what advertising does for him when it appears in the industrial, trade or professional publications that serve the specialized market to which he sells:

Says Mr. Kistenberger:

"I happen to know that better than 50% of my sales to new companies can be traced to leads from our business paper advertising. Another 25% of my sales to new owners I close after following up leads that can't be traced directly to our advertising, but I know darn well that that's where they come from because that's about the only place they could learn about our metallizing systems.

"It's been my experience that our trade advertising is getting to the right people. In many cases this man is an executive who is hard to see on a cold call. But he's a guy that will take the time and trouble to read and he's just the one to drum up interest in metallizing down the line in his company. In other words, you get more action if the suggestion comes down to the production department or the plant engineer from this executive. Of course, I don't mean to say that people will just read about a product like ours and instruct someone to write out an order. It's not that simple. But they do know about metallizing from our advertising and sometimes a surprising amount. That was particularly true of our new ceramic spraying equipment which was introduced last year and which got us into fields we'd never been in before. I think that getting a new product known is usually a pretty tough job but the leads our advertising got us were a big help in reaching the right people."

Why not ask your own salesmen what your company's business publication advertising does for them. If their answers are generally favorable you can be sure that your business publication advertising is really helping them sell. If too many answers are negative it could well pay you to review your advertising objectives – and to make sure the publications that carry your advertising are read by the men who must be sold.

The Manufacturer

NBP

One of the 207 members of National Business Publications, Inc. . . . each of which serves a specialized market in a specific industry, trade or profession.

IP new products

. . . starts on page 26

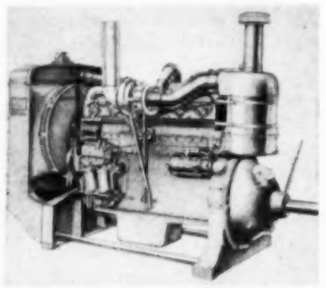
706-Pneumatic pump for high-head pumping

Designed for construction, mining, and manufacturing operations, diaphragm-type pneumatic pump for high-head

pumping can be used as sump pump. Moves fluids with 60% solids or highly abrasive liquids. Pump is fireproof and explosion-proof. Weighs only 65 pounds, is 22 inches high and 12 in. dia. THE LAYTON CO., INC.

707-Turbocharged engine rates 250 bhp

Turbotorque power unit UDT-1091 attains 250 brake horsepower rating at 1500 rpm, 50 hp over naturally aspirated counterpart, previous top horsepower unit in International line.



Exhaust-gas-driven turbocharger moves 60% more air through 14-in. dia air cleaner. Extra supply of air to cylinders cuts fuel consumption, gives lower exhaust gas temperatures. Extra large counterbalanced crankshaft and heavy flywheel prevent stall at peak loads. Full power is instantly available. INTERNATIONAL HARVESTER CO.

(continues on page 32)

Standardized plugs are inserted easily, securely and safely at conveniently spaced plug-in openings—one plug-in opening to every foot of duct. Reinforced fingers insure positive pressure contact. Seven types of plugs are available.

Your BullDog field engineer will be most happy to give you complete details on Plug-in Duct, Lo-X® Duct and the many other BullDog products. You'll find his electrical know-how very helpful whether you plan a new system or intend to expand or modernize existing facilities.

Plug in new circuits—cut expansion costs!

Stepped-up production usually demands extra power—but advance planning keeps expansion costs right in line. With a BullDog distribution system, new circuits to serve increasing demands are as close as BullDog Plug-in Duct. You simply plug in extra power when and where you need it—make a safe, convenient connection in minutes, without even interrupting the flow of current! There's no downtime for rewiring, no waiting for the power you need!

See your electrical contractor or the BullDog field engineer—learn how a co-ordinated BullDog distribution system, from safety switches to unit substations, provides full efficiency, safety and the flexibility that means economical expansion. © BEPCO

IF IT'S NEW... IF IT'S DIFFERENT... IF IT'S BETTER... IT'S

BULLDOG

ELECTRIC PRODUCTS COMPANY

A DIVISION OF I-T-E CIRCUIT BREAKER COMPANY

BullDog Electric Products Company, Detroit 32, Michigan • A Division of I-T-E Circuit Breaker Company • *Export Division:* 13 East 40th St., New York 16, New York. *In Canada:* BullDog Electric Products Company (Canada), Ltd., 80 Clayson Rd., Toronto 15, Ontario.

Circle 102 on READ-N-CIRCLE card for more data

HOW YOU SAVE...

. . . getting drier Compressed Air

Direct saving in the cost of cooling water saves the price of the Niagara Aero After Cooler (for compressed air or gas) in less than two years.

Extra, for no cost, the drier air gives you a better operation and lower costs in the use of all air-operated tools and machines, paint spraying, sand blasting or moisture-free air cleaning. Water saving also means less expense for piping, pumping, water treatment and water disposal, or you get the use of water elsewhere in your plant where it may be badly needed.

Niagara Aero After Cooler assures all these benefits because it cools compressed air or gas below the temperature of the surrounding atmosphere; there can be no further condensation in your air lines. It condenses the moisture by passing the air thru a coil on the surface of which water is evaporated, transferring the heat to the atmosphere. It is installed outdoors, protected from freezing in winter by the Niagara Balanced Wet Bulb Control.

Write for Bulletin No. 130.
Address Dept. IP-8

NIAGARA BLOWER COMPANY
405 Lexington Ave., New York 17, N.Y.
District Engineers in Principal Cities of U. S. and Canada

Circle 126 on READ-N-CIRCLE card

IP new products

. . . starts on page 26

708-Plastic jars boost battery capacities

Using heat-resistant polystyrene plastic battery jars in stationary industrial batteries permits increase of rated capacities in Exide F-line. Plastic jars are permanently leak-proof. Jar cover, also polystyrene, is

permanently bonded to jar. Plastic jar gives more space between plates and top and bottom of jar, increasing electrolyte volume. In normal float service with battery always connected to charging line, water need be added only once a year to maintain adequate electrolyte level above plates. Manchex F series is rated from 415 to 996 amp/-hr, Tytex F series from 469 to 1173 amp/hr, both at 8-hour discharge rate. Elements are hung on special ledges molded in side walls. Hard rubber cradles beneath plate straps prevent scale falling between plate separators. EXIDE INDUSTRIAL DIV., THE ELECTRIC STORAGE BATTERY CO.

709-Nuclear purifier package unit

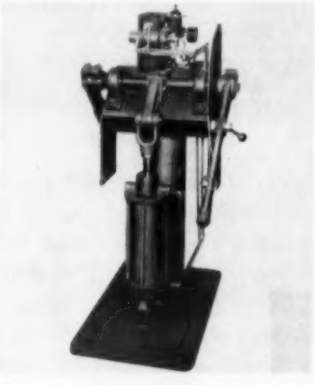
Nuclear purifier package unit cuts cost of removing dangerously radioactive wastes. Contaminated water passing through purifier resin bed exchanges radioactive ions for nonradioactive ions. Radioactive ions are absorbed in resin bed. Water leaving purifier is essentially free from radioactivity and can be safely discharged as waste or recycled for reuse. Unit may be used for cation exchange, anion exchange, or mixed-bed demineralizing. May be used with granular activated carbon to filter and absorb organic impurities. Unit is 15 in. dia by 40 inches high. When unit's capacity for removing radioactivity is reached, unit can be shielded with metal or concrete before disposal and burial. THE PERMUTIT CO.

710-Speed transmitter measures to 1600 rpm

Type 16A pneumatic speed transmitter produces a pneumatic output linearly proportional to rotational speed of machinery. Operates on force balance principle with magnetic actuation of standard pneumatic circuit. Transmitter range is adjustable from 0 to 1600 rpm through 0 to 2400 rpm. Range can be extended from 0 to 320 rpm through 0 to 5300 rpm by optional speed changers. Feedback pressure of 3-15 psig can be piped to an indicator, recorder, or controller calibrated in units of speed for accurate measurement. THE FOXBORO CO.

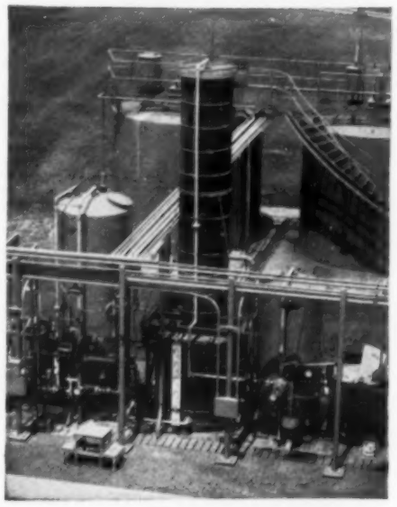
711-Pneumatic drives for valves, dampers, vanes

New line of pneumatic drive units may be adjusted with linear, square, or square root characteristics, or may be field characterized for special applications. Drives position control



devices such as butterfly valves, control valves, dampers, louvers, rheostats, vanes, and variable-speed drives. All five models have 90-degree angular rotation, are equipped for manual rotation and consume 1.5 scfm at 80 psig. Positioning accuracy is better than 0.2%. COPES-VULCAN DIV., BLAW-KNOX CO.

ILLCO-WAY ionXchange



"SILICA: 0.003 PPM, OTHER SOLIDS UNMEASURABLE..."

With some doubt as to the outcome, the de-ionization units pictured above were installed outdoors at a Texas power and light company, to replace evaporation equipment as a means of purifying feed water for a high-pressure boiler. After three years, results far exceeded guarantee and expectations. From raw water containing 27 ppm of silica and dissolved solids totaling 365 ppm, the quality of the effluent is reported as: "Silica, zero to 0.005 ppm, average 0.003 ppm. Other solids are unmeasurable."—This is a good example of what modern ILLCO-WAY ionXchange can accomplish.

BOILER FEED WATER FOR POWER PLANT

The particular plant shown above consists of a cation exchanger, an aerator, and a mixed-bed deionizer. The large tanks in the background hold a supply of regenerants. Operation is manual throughout, a preference of the purchaser. *Results have proved even more economical than expected.*

ionXchange
ILLINOIS WATER TREATMENT CO.
ILLCO-WAY
840 CEDAR ST.
ROCKFORD,
ILLINOIS

NEW YORK OFFICE: 141 E. 44th St., New York 17, N.Y.
CANADIAN DIST.: Pumps & Softeners, Ltd., London, Ont.

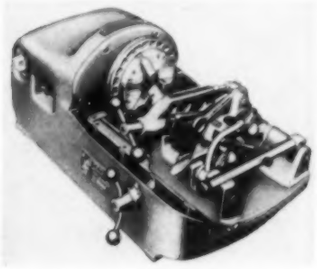
Circle 105 on READ-N-CIRCLE card

712-Breakers eliminate fault single-phasing

Circuit breakers eliminate single-phasing on faults, can be quickly reset after breaking on overload or usual fault current. Consist of modified AB breaker and current-limiting fuse with three tripping elements: time-delay thermal, instantaneous magnetic, and current-limiting fusible. Available in three frames in NEMA standard ratings of 100, 225, and 400 amps, two or three poles. Interrupting capacity at 250 volts dc and 600 volts ac is 100,000 rms amps. WESTINGHOUSE ELECTRIC CORP.

713-Pipe, bolt machine has pivot-mounted dieheads

Beaver S-4 Speed-O-Matic pipe and bolt machine has Universal-type diehead with three sets of high-speed steel dies and



threads from 1/2 to 2 inches. Duo-type and mono-type dieheads are also available. Cutoff, dieheads, and reamer are pivot mounted to swing out of way when not in use. Oiling tube directs cutting oil to threading dies, shuts off automatically when tube is out of position. Wrenchless chuck gives positive grip whether machine is forward or reverse. BEAVER PIPE TOOLS, INC.

714-Hydraulic brake aids load spotting

Hydraulic brake provides powerful service braking, accurate load spotting control on light industrial cranes. Can also be used for emergency stopping, holding, and service braking on industrial machinery. Brake is 6 by 3 inches. Bolted attachment permits convenient lining replacement with pre-drilled replacement blocks. Designed for use with hydraulic brake fluid, brake can be furnished with mineral oil compatible parts for special fluid power holding operations. WAGNER ELECTRIC CORP.

715-Carbon shell heat exchangers

Flexibility of standardized line of single and double-pass carbon shell heat exchangers permit simple solution to many heat exchanger problems. Package stainless-steel heat exchanger units are available in sizes from 56 to 316 sq ft. THE PFAUDLER CO.

MORE INFORMATION

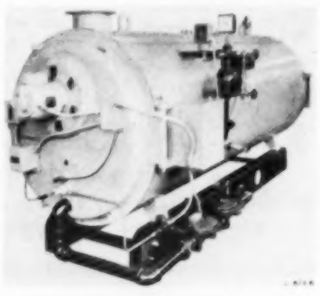
For more detailed free information on these products just circle the key numbers on a READ-N-CIRCLE card on page 45 or 46.

716-Cork mounting pad in waffle-grip design

Cork bonded between oil-resistant neoprene is embossed with waffle pattern in machinery mounting pad designed to control noise and vibration, eliminate machine walking. With pad, machinery installation cost is almost halved by eliminating bolting and cementing to floors. Design prevents dirt accumulating beneath pad. THE KORFUND CO.

717-Package boilers to 2 million Btu

Progress package boilers now carry 50- and 60-hp ratings (1,670,000 and 2,010,000 Btu). Forced-draft system combines with a 4-pass design for high



heat transfer, controlled combustion, and low stack temperatures. Either gas- or oil-fired, oil burner is multinozzle, pressure atomizing type with automatic two-stage ignition for No. 2 light oil. Gas burner is multiple jet, high radiant type for use with natural, manufactured, or mixed gases. Burners operate on the on-off principle. CLEAVER-BROOKS CO. ♦ ♦

RAMBLINGS ON INSTRUMENTATION

Our "System Safari"
Plunges Onward . . . Ever Onward

Last month we plunged recklessly into a conducted safari of boiler plant control systems, going on the rash assumptions that, (1) boiler plant people might achieve better understanding of this subject and (2) having achieved said better understanding, might be apt to buy more Hays instruments or complete systems. If, as a result of our first discussion you *did* gain a better understanding of control systems but bought *somebody else's* products, please try to pay a little closer attention from here on.

In our last Ramblings we ventured a comparison of the Draft Gauge, (A) to a stethoscope enabling the power plant "doctor" to keep a running diagnosis on his system's respiration.

Continuing the medical analogy, the Flow Meters (B) record the metabolism rate of the system by metering fuel and water flow into the boiler and steam flow from the boiler. A glance at the Flow Meters tells the engineer of any unhealthy conditions, and alerts him to any untoward demands on the system.

The Hays Electronic Mercuryless Flow Meter (paying attention?) is, with due allowance for a certain built-in prejudice on our part, the simplest and most efficient instrument of its kind. It is fully electronic in operation and uses a Hays-designed differential transmission system that makes it independent of line voltage fluctuations and assures maximum sensitivity.

Also, our design eliminates an ancient and expensive bugaboo by using no mercury in the transmitter. With mercury weighing in at about $75 to $100 a refill these days, this represents a considerable savings. Instead Hays uses an overpressure-proof metallic bellows sensing element. The unit is extremely sensitive, with maximum accuracy of ±¼% of full scale differential. And the whole wondrous transmitter mechanism is packaged in a neat unit no bigger than a good unexpurgated edition of the "Arabian Nights".

Up to four different records can be made on the single 12" recorder chart, including air flow, temperature and pressure. Accurate integration through the widest load swings is assured by use of a mechanical type continuous integrator.

In the short time this meter has been on the market we have sold more than 1,800 units . . . without resorting to bubble gum, plastic space platforms or Marilyn Monroe cut-outs. Just clip this ad, send it to me with your name and address and we will send you our recent bulletin on Electronic Flow Meters, in a plain wrapper, of course.

HLP! HLP!

Hays Corp. nds. service engrs. to instll. & srvce. Hays prods. in cstmrs. plnts. Reqts: a BS deg. in E.E., M.E., or Chem. E. and/or exp. w/Stm. Pwr. Plnt. opration & instrmntn. Petro-chem. exp. also gd. Mich. Cty. is swl. cmnty. in whch. to lv., rs. kds., hv. fn. Exclnt. oppty., wrt. us tdy.!

Phil Sprague Jr.
President

THE HAYS CORPORATION • MICHIGAN CITY, INDIANA

Circle 141 on READ-N-CIRCLE card for more data

HOW TO GET BETTER COMPRESSED AIR DRAINAGE!

USE THE RIGHT TYPE TRAP FOR THE JOB!

TYPE OF TRAP	SNAP ACTION (Fig. 1)	REGULAR BALL FLOAT (Fig. 2)	INVERTED BUCKET (Fig. 3)
Handles oil?	Light oil only	No	Very well
Handles dirt?	Moderate	No	Very well
Air loss?	None	None	Small
Requires priming?	No	No	Yes
Float collapse or leakage?	Remote	Remote	Impossible
Gravity drainage to trap required?	Yes	Yes	No

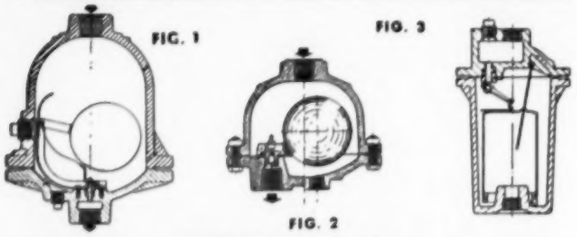


FIG. 1 FIG. 2 FIG. 3

GET THE FACTS:

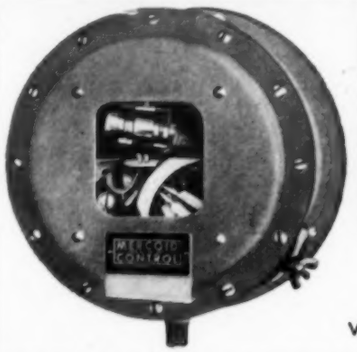
FREE AIR TRAP BULLETIN *Send Today*

ARMSTRONG MACHINE WORKS

8203 Maple Street • Three Rivers, Michigan

Circle 137 on READ-N-CIRCLE card for more data

MERCOID® PRESSURE CONTROLS FOR OUTDOOR SERVICE



Weather Proof
Drip Tight
Semi-dust Tight
Sleet Proof
Splash Proof
Moisture Resistant
Rain Tight
Water Tight

Equipped with Sealed Mercury Contacts

External Adjustments

Visible Calibrated Dial

AVAILABLE IN 17 PRESSURE RANGES FROM

0-30" VAC. TO 300-2500 PSI.

WITH THE SENSITIVITY YOUR APPLICATION REQUIRES

Mercoid weather resistant controls are also available for temperature and liquid level applications.

Write for Bulletin 14PW

THE MERCOID CORPORATION

4201 BELMONT AVE., CHICAGO 41, ILLINOIS, U.S.A.

Circle 142 on READ-N-CIRCLE card for more data

Eliminate "P I" time with a* PICK

Exact temperature control

pick STEAM INJECTION WATER HEATERS

INSTANTANEOUS WATER HEATER

With the Pick Instantaneous Water Heater, processes are speeded up and made easier. Designed for high pressure steam (40#-125 psi), the Pick Heaters supply hot water in desired quantity and with accurate temperature control. Either intermittent or sustained operation, the Pick Instantaneous Water Heater is your most dependable source for hot water. Check these other cost saving features of the Pick Heaters.

- No Storage Space — compact design permits out-of-the-way installations in corners, on walls, overhead, etc.
- Maintenance Cost is Low — can be cleaned in minutes, worn parts easily replaced.
- Fuel Savings Substantial — steam injection is the most efficient method known for heating water. No heat loss as water is heated only as used, no storage tanks for water to stand and cool off.

* Process Idle Time — the time your employees waste waiting for hot water.

FOR ALL INDUSTRIAL APPLICATIONS

Primary Heater

Capable of supplying any specified volume of hot water up to 300 gallons per minute at 140° F. rise. These heaters are practical as a primary source of hot water for countless industrial needs.

Supplementary Heater

Easy installation and accurate control at any temperature makes these heaters useful for specialized "spot" application near the point of use.

"Booster" Heater

To augment overloaded or certainly inadequate facilities, these heaters can be installed to automatically "boost" and correct temperature deficiencies.

Mail this coupon today for further information on Pick Instantaneous Water Heaters, to:

PICK MFG. CO. Dept. IP-57
West Bend, Wis.

Name.....

Company..... Title.....

Address..... City..... State.....

Please check below reason for request:
☐ Application ☐ File ☐ Other.....

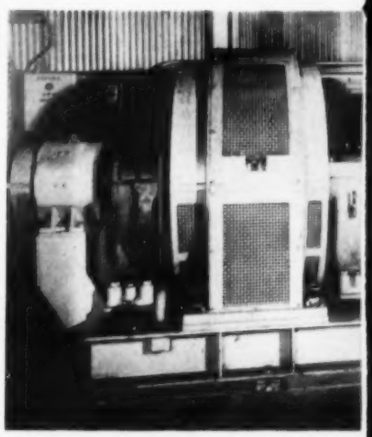
PICK MANUFACTURING CO. West Bend, Wis.

Circle 110 on READ-N-CIRCLE card for more data

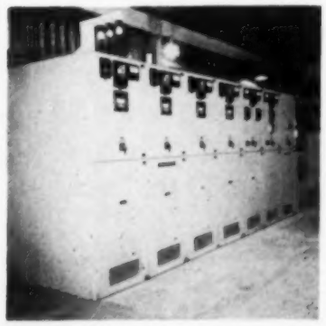
General Steel uses dc

ACCURATE CONTROL of production and materials handling equipment is assured at General Steel Castings Corp., with dc motors. Loss of dc supply would shut down all production equipment, while not affecting plant utility system and lighting.

Connected electric load at the



Commonwealth plant, Granite City, Ill. is 3600 horsepower. About 40% of this load is dc. The dc load includes all variable-speed motors and overhead cranes. Dc supply failure would immobilize production equipment and result in costly pro-



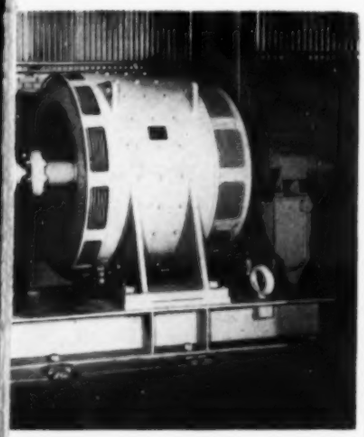
duction losses at this plant.

Prior to 1956, all dc current was supplied by two 30-year-old mg sets, rated at 1800 kw and 900 kw. To guard against failure of these antiquated units, a new Fairbanks-Morse mg set

Castings Corp. for control

was installed. The new unit consists of a 1500-hp synchronous motor and a 1000-kw dc generator. The 1500-hp, 3-phase, 60-cps, 2300-volt motor has a 10-kw shunt-wound dc exciter. It is direct-connected to a 1000-kw, 250-volt generator, which has a 3-kw shunt-wound exciter.

New mg set is located adjacent to much of the dc equipment it serves. A new substation was installed at the same time as new set, complete with control and distribution panels, and storage batteries to power the switchgear.

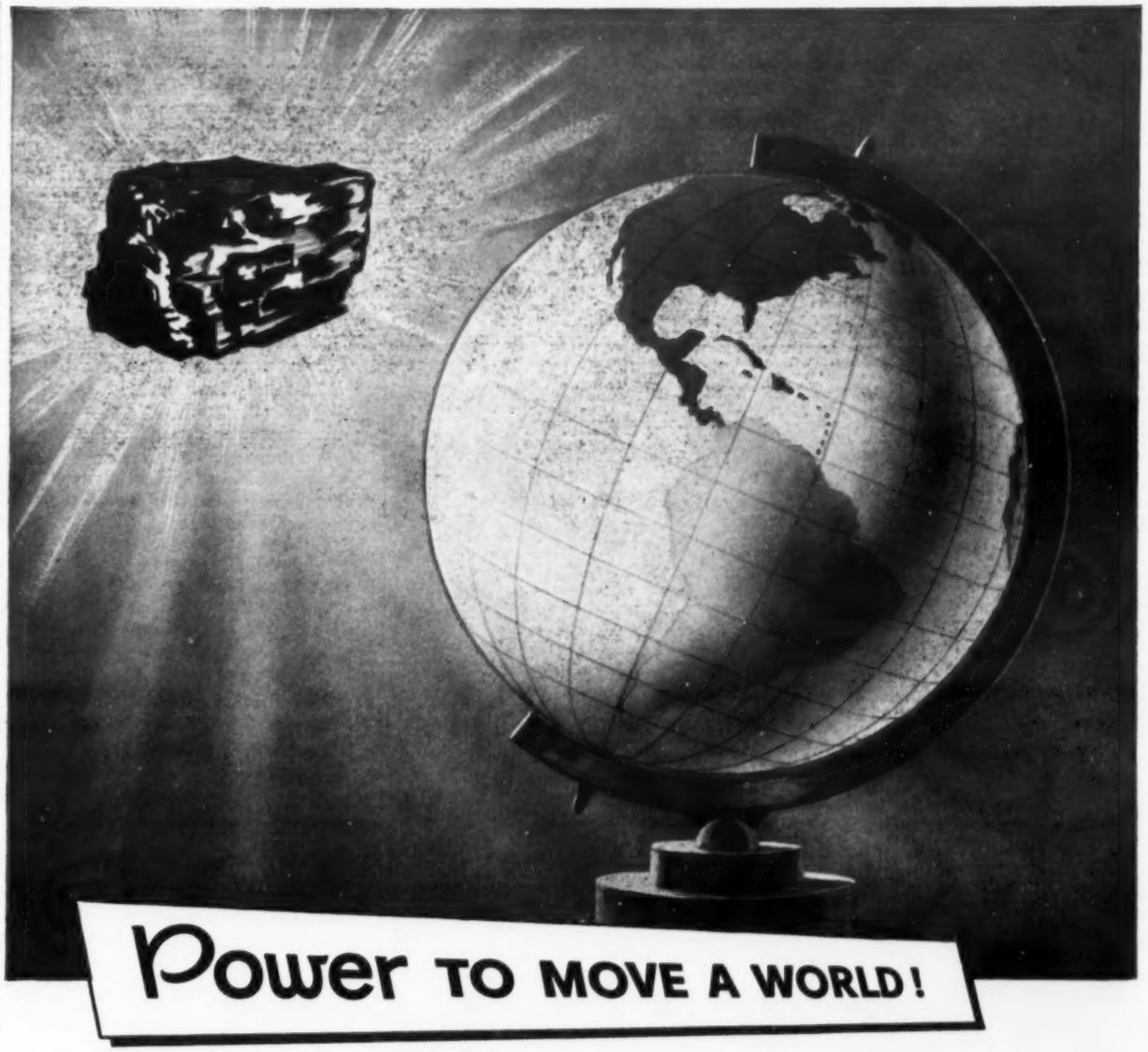


If desired, the new substation can be cut off from the old and operated independently to supply the south section of the plant.

Equipment arrangement allows for flexible operation. The new mg set can be tied in with the old substation and be operated in parallel with the old dc generators. If load is light, the new generator can be operated by itself to handle the load alone.

Mg set is manually started but is arranged to restart automatically after any interruption of power supply to its motor. An alarm sounds if the generator stops.

Thus, General Steel Castings have eliminated danger of costly shutdowns and have obtained a more dependable and flexible power supply. ♦ ♦



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Handy Guide Subject Index

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stand up under the toughest operating conditions

- Hub and blades are precision-finished aluminum-alloy castings. Cast aluminum construction combines high strength with exceptional resistance to corrosion.
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handy guide to engineering literature

AIR CLEANING EQUIPMENT

130-Strike pay dirt year after year

Cyclone collectors give superior dust collection; save on maintenance. Read page 37—Buell Engineering Co., Inc.

400-Manual of dust collection

"The Collection and Recovery of Industrial Dusts," Manual 101, discusses types of dust, techniques used in analysis, lists factors which influence choice of equipment, and explains operation.Thirty-two pages. Buell Engineering Co., Inc.

600-Contaminants in the air

Special industry report on air pollution describes various contaminants and troubles they cause. Special report from Industry Power. (Single copies free — 2 to 24 copies, 25¢ each. Quantity prices on request.)

AIR CONDITIONING, HEATING, VENTILATING

127-Do you have space heating problems?

Stainless steel direct-fired heaters install easily. Operate automatically, need little maintenance. Read page 38—Reznor Manufacturing Co.

116-Check performance at a glance

Control pressure gages simplify and add to efficient operation of air conditioning, heating, and ventilating systems. Read page 5—Johnson Service Co.

119-For high-volume air movement

Belted and direct-driven fans in ring, duct, or square panel types. Special components for corrosive conditions. Read page 40 — Aerovent Fan Co., Inc.

401-How to choose utility fan sets

Capacity tables in Bulletin 8314 give motor horsepower, fan speed range and delivery under varying static pressures for Sirocco utility sets. Sample selection problem aids in estimating quantity of fresh air required. Forty-eight pages. American Blower Div., American-Standard.

BOILERS AND ACCESSORIES

118-For safe, continuous boiler operation

Water columns in various styles and capacities meet any power plant need. Read page 10 — The Reliance Gauge Column Co.

110-Gives hot water fast, economically

Pick heaters supply hot water in desired quantity and at desired temperature. Read page 34—Pick Manufacturing Co.

125-Low-Cost steam at twice normal rating

Read how one Leffel boiler user operated a boiler at twice normal rating without difficulty. Read page 12 — The James Leffel & Co.

107-How to avoid expensive downtime

Yarway seatless blowoff valves eliminate most common source of boiler blowoff valve trouble. Read page 23 — Yarnall-Waring Co.

152-Automatic boilers fire oil or gas

York offers complete selection of automatic boilers in large size range. Boilers complete on one skid, fully wired. Read page 6 — York-Shipley, Inc.

402-Are dirty boiler tubes your problem?

Boiler tubes need cleaning, replacement? Bulletin 59 describes the entire line of precision-made boiler tube maintenance tools. Includes complete data on tube cleaners, cutters, and expanders. Lists sizes, weights, and operating speed of each unit. Eight pages. Aire-tool Manufacturing Co.

403-Heating with hot water?

Bulletin 923 contains an easy-to-understand discussion of industrial hot-water heating prob-

(continues on page 47)

Maintenance

. . . starts on page 16

feel that with the same people working on the elevators from year to year, we can take advantage of developed history on each elevator.

When the master program indicates that a regular inspection is due, maintenance personnel use our Form L-750 as a guide for that inspection. This details items to be checked and provides space to note deficiencies that cannot be corrected at that time by the inspection team.

record keeping follows strict routine

First record to be filled out is the Elevator Inspection Sheet No. 1, which details all information on location, type, specifications, serial numbers, etc., on a particular elevator.

Next a set of Kardex cards are filled out for cost control purposes, giving expense account and equipment numbers.

specific example shows how system works

A specific instance shows that Elevator No. 21A was given a regular inspection, using Form L-750 as a guide. The motor was leaking oil. This was noted on the reverse side of the form. When checked by the engineering department, next step was filling out a Job Order Form describing work to be done and estimating cost. (In this case, $200.) Repair job was then scheduled for work as indicated by master program of manpower availability.

When work was completed, Form L-1070, Job Order Cost Record was completed, listing material and labor costs. All information thus developed is transferred to Kardex file on this particular elevator by the engineering department.

maintenance information must be used

Good preventive maintenance does not only consist of keeping records, but its success may well depend on the intelligent use of the information. Preventive maintenance, as its name implies, means doing work now to prevent more serious trouble later.

These, then, are the end results of planned, directed preventive maintenance at Eli Lilly Co.

- Record complete information on how, when, where, and why maintenance money is spent,
- Review Job Order estimates to determine how and where cost reductions can be incorporated,
- Use maintenance histories as a basis for review when new equipment purchases are contemplated. ♦ ♦

Complete maintenance records are filed on Kardex cards. This provides ready access to information for cost control purposes.

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...year after year!

Buell Cyclone collectors pay off two ways: extra efficiency from the start . . . and extra years of operation, with little if any maintenance. Unique features like Buell's exclusive Shave-off deliver an extra percentage of dust collection efficiency: in nearly all cases, Buell installations pay for themselves in just a few years. And heavy plate construction, scientific proportioning, side entry of dust-laden gases are reasons why they keep on earning for many, many years. For specific details, write for "The Collection and Recovery of Industrial Dusts". Just write Dept. 90-H, Buell Engineering Company, Inc., 70 Pine Street, New York 5, N. Y.

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DUST COLLECTION SYSTEMS

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- completely automatic operation
- practically no maintenance required
- ideal for primary or supplemental heating in all types of industrial building, new or old
- write for free bulletin giving complete details and specifications

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renewable fuses

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Jamestown, New York

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Lubrication

. . . starts on page 20

The fourth classification, Special Purpose Lubricants, Greases, and Compounds, are shown with recommended uses, in Tables IV and I.

general purpose greases have wide range of uses

The grease we use for general purpose lubrication was developed to replace one which did not, for our purposes, adequately retard corrosion under high humidity conditions. We use it principally because it has good low-temperature properties down to –65 F, will not thin out in gear boxes, and can withstand high temperatures. (1000 hours minimum in a high-speed ball bearing at 10,000 rpm and 250 F.)

Low-temperature grease (MIL-G-7421) is specified for anti-friction bearings and for other control system parts where minimum drag at low temperatures is vitally important. Since this grease will not withstand temperatures above 225 F, it is not specified in place of the general purpose grease unless absolutely necessary.

high-temperature grease is also used at -40 F

The third classification grease (MIL-L-3545) is used for generators and magnetic bearings that operate at relatively high temperatures, yet do not require low-temperature performance. This grease can withstand 300 F in a high speed bearing for 600 hours at 10,000 rpm. We also use this grease for lubricating anti-friction bearings that must start at –40 F (if an adequate run-in period can be allowed to properly channel the grease before starting).

We have used lubricants not listed in the tables for special purposes if we have reliable test data indicating satisfactory performance. These have included:

- Synthetic, non-spreading clock and watch oil (2-47-B), used for precision instrument lubrication
- Graphited oil (one pound of graphite to a gallon of MIL-G-67111, MIL-L-7870A, MIL-L-644A, or MIL-L-6082A), used wherever graphite lubrication is indicated, but never in anti-

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Why the Wrangle About Water Treating?

Let's face the facts. In many cases, chemicals alone can do an excellent job of treating water. In other cases, equipment is justified by results and operating costs. And many times, a combination of equipment and chemicals is the answer.

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For facts, write for bulletins . . . or, better still, let us put you in touch with our nearest representative.

*Manufacturers of Water Treatment, Feeders, Testing Equipment, Zeolite Water Softeners, Deionizers, Dealkalizers, Clarifiers, Aerators, Deaerating Heaters, Filters, and related products.

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STANDARD PRESSED STEEL CO.
HALLOWELL POWER TRANSMISSION DIVISION **SPS**
JENKINTOWN PENNSYLVANIA
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friction bearings or in electric equipment

- Ship's grease (MIL-G-16719), used primarily in ball or roller bearings operating at high temperatures in electric motors, but never where main action involves sliding of metal on metal (as in journal bearings or gear trains). Normal operating temperature range of this grease is 0 to 300 F
- Petrolatum (AN-P-51), used for summer lubrication where rust prevention and retention are essential, and where soap content of an alternate grease is objectionable. We also use this grease as a protective coating on battery terminals
- Lead soap and mineral oil base grease (MIL-L-7645), used on gears, screws, and threaded parts where a semi-solid noncorrosive, extreme-pressure lubricant is required. This grease takes higher loads than petroleum oils, yet is not a hypoid substance
- Dry-film lubricant (molybdenum disulfide powder dispersed in a coating resin), used in inaccessible areas where other lubricants would collect dust or dirt. It is applied by brushing, dipping, spraying, or baking like paint. We also use this on parts carrying low static loads or operating at extreme temperature limits, (−65 F to 650 F). The film can be applied to mating surfaces of numerous metals and non-metals where conventional oil or grease films are not satisfactorily maintained
- Impregnating oil (MIL-L-7870), applied to oil-impregnated or sintered bushings replacing oil lost through evaporation, storage, or handling
- Control chain grease (MIL-G-7118) dispersed in a standard safety solvent (P-S-661), applied to stud-type chains used on sprocket gears, but not to the sprocket gear teeth. Solvent helps to saturate the chain and improves drainage in removing excess grease
- Cable grease (MIL-C-16173), used to recoat cables where protective coatings have been disturbed
- Control grease (MIL-G-3278), used to lubricate Teleflex cables, or push-pull control units where function depends on a thin grease film
- Electronic equipment lubricants (MIL-G-3278), used on most anti-friction bearings, ring, spur, bevel or worm gears.

Lubricating oils (MIL-L-7711, MIL-L-3545, MIL-L-6085) are used on dynamotor and azimuth drive motor bearings, blower components, and lightly loaded ball bearings such as in selsyn motors.

MIL specifications are intended to establish performance standards and consequently do not control lubricant composition. In other words, it is possible for the manufacturer of a lubricant meeting a given MIL specification to use any of several metal base materials. His choice of such a material is limited only to the extent that the metallic soap must enable his lubricant to perform in conformity with minimum requirements of the specification.

detailed specifications are not necessary

Since we are sure no engineer would care to compound his own lubricants, there would be no advantage in listing metal bases and physical properties.

MIL specifications are published by the Department of Defense and other government agencies. They also publish a Qualified Products List, correlating lubricant brand names with MIL specifications. This is available to anyone requesting it. At Convair, lubricants are purchased on the basis of quotations from several vendors whose names appear on the QPL. Lubricants are labeled with MIL specification numbers and are specificed on engineering drawings whenever necessary. ♦ ♦

?

Will our power supply survive nudear attack?

INDUSTRY POWER'S editors bring you the Department of the Interior's plans for national power control in case of nuclear attack. Our spokesman—the honorable Fred A. Seaton, Secretary of the Interior. For the answer . . . .

see page 13

850 tubes rolled in less than 5 hours!

AIRETOOL Automatic Tube Expansion Control System simplifies and speeds accurate tube rolling!

A large coppersmithing company* recently faced one of the biggest tube rolling and expanding jobs of its kind when they had to roll 850 4 in. OD x 13 gage copper tubes in a limited time. Using AIRETOOL'S Automatic Tube Expansion Control System, they rolled those tubes at a rate of one every twenty seconds . . . completed the job in *less than five hours!*

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type LS

4-blade

industrial fans

Designed for high-volume air movement against resistances ¾" S.P. Featuring new, wider 4-blade "Macheta" Airfoil propellers, "LS" fans are available in ring, duct or square panel types. Standard construction features mean lower initial costs, with more efficient operation. Aerovent "LS" fans are the practical solution to all standard air-moving problems. Special motors, propellers, coatings available for corrosive conditions.

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Available in belted or direct-driven, with ring accurately drilled to facilitate installation. 12" to 48". Capacities to 32,000 CFM.

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Designed for use in all standard duct systems. More efficient performance at lower speeds, against static pressures to ¾" S. P. Sizes 24" to 48".

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Certified Ratings

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Ash and Boyd Sts. Piqua, Ohio

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Fluid mechanics

. . . starts on page 22

a form of specific energy (ft lb/lb), which expresses energy per pound of fluid flowing, we can write

$$\frac{p_1}{\gamma} + Z_1 + \frac{V_1^2}{2g} + Ju_1 + Jq + E_w = \frac{p_2}{\gamma} + Z_2 + \frac{V_2^2}{2g} + Ju_2 \quad (4)$$

where:

pressure = p lb/ft²

specific weight of fluid = γ lb/ft³

elevation of point about some datum (arbitrary) = Z ft

flow velocity = V ft/sec

mechanical equivalent of heat = J = 788 ft lb/Btu

internal energy of fluid = u Btu/lb

heat transfer to fluid = q Btu/lb

external work done on fluid per pound of fluid flowing = E_w ft lb/lb

these terms are called heads

It is apparent that each term of this equation has ft-lb/lb or feet as its dimension. The various terms are usually called heads; pressure head, elevation head, and velocity head. Because of our choice of sign convention for the heat transfer q and external work E_w, Eq. 4 indicates the redistribution of energy in a fluid flowing from point 1 to point 2.

As we have written it, Eq. 4 represents the energy equation

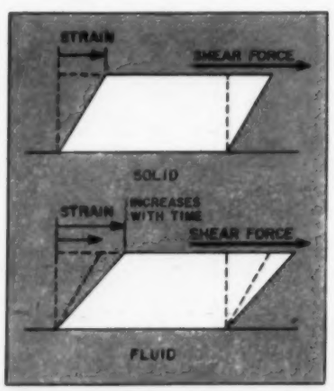
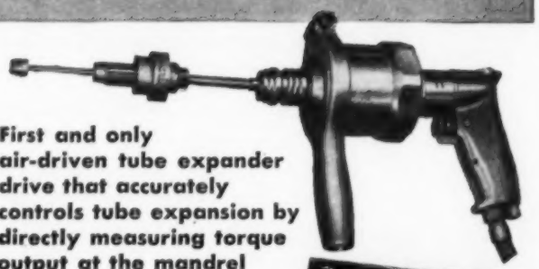


Fig. 1 — Solids withstand shear with deformation or strain, depending on force magnitude.

For Expanding Heat Exchanger Tubes

NEW WILSON Torq-Air-Matic



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Only the Wilson Torq-Air-Matic offers all these features: air driven, automatic trip-off, completely integrated, non-electrical, non-frictional, calibrated in ft lbs torque, lightweight, simply adjusted.

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WILSON TW 868

TUBE CLEANERS • TUBE EXPANDERS

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as written in thermodynamics, except that it is usually in terms of Btu/lb of fluid flowing — through division by J. In many fluid mechanics situations, thermal aspects are small or negligible. Thus, for the special case where flow of a *frictionless incompressible fluid* with no work is being considered, Eq. 4 becomes

$$\frac{p_1}{\gamma} + Z_1 + \frac{V_1^2}{2g} = \frac{p_2}{\gamma} + Z_2 + \frac{V_2^2}{2g} \quad (5)$$

This states that the sum of the potential $\left(\frac{p}{\gamma} + Z\right)$ and kinetic $\left(\frac{V^2}{2g}\right)$ energies per pound of fluid flowing are constant along the flow. This is known as *Bernoulli's theorem*.

In many cases, the assumptions upon which Eq. 5 is based are too restrictive. There may well be some external work done by a machine and some mechanical flow energy transferred into heat through the action of viscosity (Fig. 5). In this form, the energy is unavailable to assist further in the flow process and we call it a head loss. The *generalized Bernoulli theorem* is thus written,

$$\frac{p_1}{\gamma} + Z_1 + \frac{V_1^2}{2g} + E_W = \frac{p_2}{\gamma} + Z_2 + \frac{V_2^2}{2g} + h_L \quad (6)$$

By comparison with Eq. 4, we see that the head loss term $h_L = J(u_2 - u_1 - q)$ represents the change in internal energy

(continues on page 42)

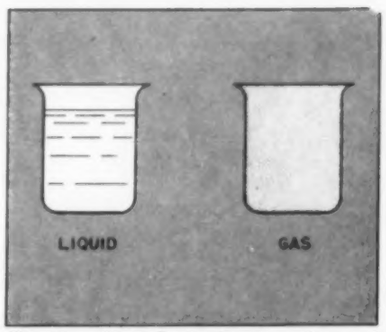

Fig. 2 — Liquids conform to shape of container, but are limited on top by free surface. Gases expand to fill it.

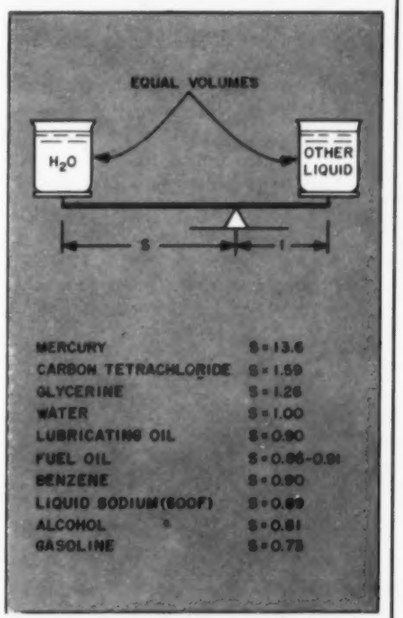

Fig. 3 — Shows balance method of determining specific gravity, tabulated with values for some common liquids.

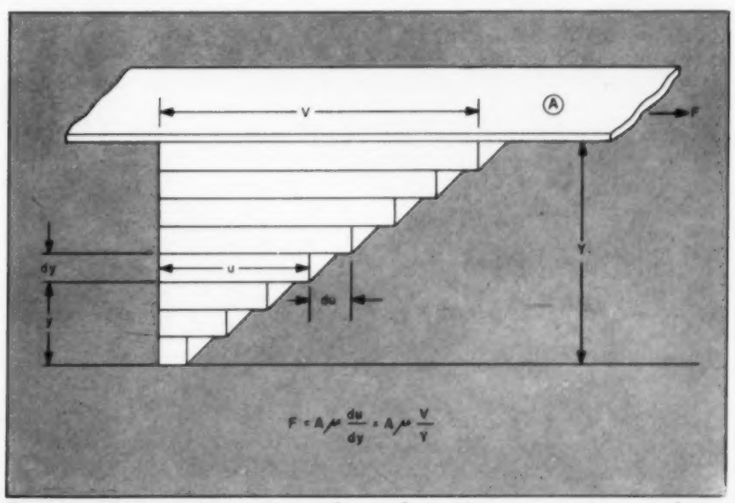

Fig. 4 — Viscous force F equals product of area, viscosity, and velocity gradient. Y is distance between fixed and moving parallel plates.

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These two cable trays have been thoroughly field tested in hundreds of large industrial installations, in new plant construction, in power plants, in modernization, and for power distribution in all types of manufacturing processes. A new catalog, just off the press, gives full information and installation techniques. Ask for your FREE copy today.

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109

PRODUCTS DIVISION

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Fluid mechanics

. . . starts on page 22

modified by heat transfer. Our equation now states that the sum of potential and kinetic energies at one point plus mechanical work done on the fluid by some machine equals potential and kinetic energies at a later, downstream point plus losses that have occurred. It is particularly important to apply this equation for flow in the direction from 1 to 2, since head loss always decreases the energies in the direction of flow. We have written the equation so that E_w is positive when the machine is a pump doing work on the fluid and increasing its flow energy. For a turbine or motor, E_w is negative since the machine extracts energy from the flow.

EXAMPLE: Benzene is flowing along a pipe line from a point at elevation 20 feet where velocity is 10 ft/sec and pressure is 10 psig. What is pressure at a downstream point of 50 feet elevation if velocity there is 5 ft/sec and 2.5 feet of head loss has occurred?

SOLUTION: For benzene:

$$\gamma = 0.9 \times 62.4 = 56.1 \text{ lb/ft}^3$$

at the first location:

$$\frac{p_1}{\gamma} = \frac{10 \times 144}{56.1} = 25.7 \text{ ft}$$

$$\frac{V_1^2}{2g} = \frac{100}{64.4} = 1.55 \text{ ft}$$

at the second location:

$$\frac{V_2^2}{2g} = \frac{25}{64.4} = 0.39 \text{ ft.}$$

Entering these and the other known quantities into Eq. 6, we note that no external work is done.

$$\frac{p_1}{\gamma} + Z_1 + \frac{V_1^2}{2g} + E_w = \frac{p_2}{\gamma} + Z_2 + \frac{V_2^2}{2g} + h_L$$

$$25.7 + 20 + 1.55 + 0 = \frac{p_2}{\gamma} + 50 + 0.39 + 2.50$$

Solving, we find pressure head at the downstream point

$$\frac{p_2}{\gamma} = -5.64 \text{ feet of benzene}$$

therefore:

$$p_2 = -5.64 \times 56.1$$

$$= -316 \text{ lb/ft}^2$$

or

$$p_2 = -2.2 \text{ psi}$$

In some problems we cannot evaluate the frictional losses in advance, and these may be quite significant; or the form of the answer given by the energy approach is not convenient. In such cases, we must resort to another basic principle of mechanics — that of impulse and momentum. Sometimes, both this and the energy or Bernoulli approach are needed to completely answer our needs.

From mechanics, we know

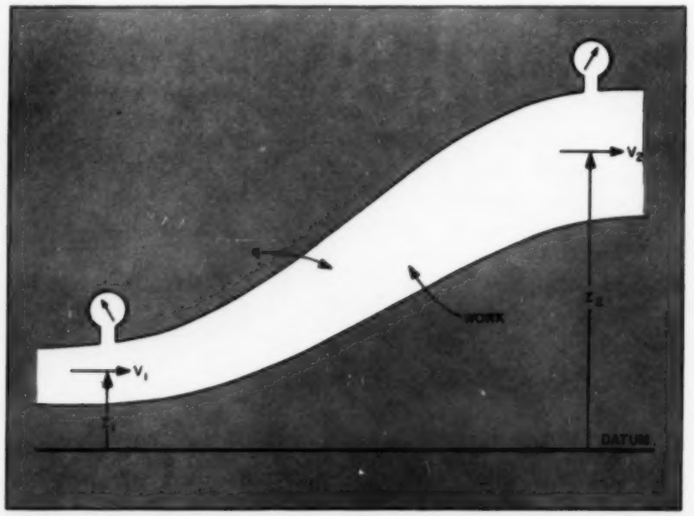

Fig. 5 — Flow system with some mechanical energy being transferred into heat through action of viscosity. This is called a head loss.

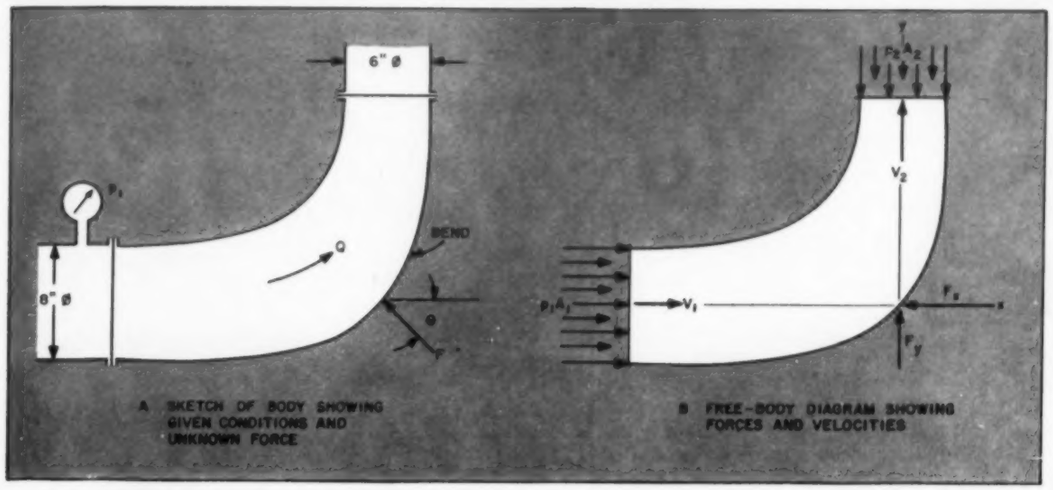
6" ø
BEND
8" ø
A SKETCH OF BODY SHOWING GIVEN CONDITIONS AND UNKNOWN FORCE
B FREE-BODY DIAGRAM SHOWING FORCES AND VELOCITIES

Fig. 6 – Free body diagram of fluid mass, used in determination of force required to hold reducing bend.

that the impulse (force × time of action) of forces on a system is equal to the change in momentum (mass × velocity) of the masses making up the system. Applying this to flowing fluids, we divide by the time interval and find that the sum of the forces acting must equal the time rate of change of momentum. For steady flow systems, this is mass rate of flow times change in velocity. The linear impulse-momentum relation is thus written

$$\Sigma F = Q\rho\ (V_2 - V_1) \qquad (7)$$

where ΣF indicates the summation of forces in the direction of the velocity change and Q represents volumetric flow rate in ft^3/sec. In applying this principle of linear impulse and momentum, we must remember that each side of the equation involves vector or directional quantities.

EXAMPLE: Water is flowing around a 90-degree horizontal 8- by 6-in. reducing bend. For a flow rate of 2.5 ft^3/sec, the pressure in the 8-in. pipe just upstream of the bend is 6 psig. What force is required to hold the bend in place?

SOLUTION: Let us assume that none of the force required to hold the bend in place is transmitted to the 8- or 6-in. pipe line. Fig. 6A shows the bend, the given conditions, and the force F to be found (in magnitude and direction). We will need the pressure (p_2) in the 6-in. pipe to complete the solution. This is found from that in the 8-in. pipe and the flow velocities.

$$p_1 = 6 \times 144 = 865 \text{ lb ft}^2$$

$$V_1 = \frac{Q}{A_1} = \frac{2.5}{0.349}$$

$$= 7.17 \text{ ft/sec;}$$

$$\frac{V_1^2}{2g} = 0.80 \text{ ft}$$

$$V_2 = \frac{Q}{A_2} = \frac{2.5}{0.196}$$

$$= 12.76 \text{ ft/sec;}$$

$$\frac{V_2^2}{2g} = 2.52 \text{ ft}$$

Although the solution of our problem primarily involves the impulse-momentum method, we must also use Bernoulli's theorem, to find p_2. Since the bend is short, the head loss between points 1 and 2 is small and we can write.

$$\frac{p_1}{\gamma} + Z_1 + \frac{V_1^2}{2g} = \frac{p_2}{\gamma} + Z_2 + \frac{V_2^2}{2g}$$

$$\frac{865}{62.4} + Z_1 + 0.80 = \frac{p_2}{\gamma} + Z_2 + 2.52$$

whence

$$\frac{p_2}{\gamma} = 13.86 + 0.80 - 2.52$$

$$= 12.14$$

$$p_2 = 12.14 \times 62.4$$

$$= 758 \text{ lb/ft}^2 \text{ ft}^2$$

We now draw a free body diagram of the fluid mass for which we are going to apply the impulse-momentum relation. This diagram, shown in Fig. 6B, indicates velocities at the beginning and end of the bend and all the forces acting on the fluid: the pressure forces at the two ends and the unknown force F. This latter represents the resultant of the pressures acting along the walls of the bend. It is shown as the orthogonal components F_x and F_y. Applying the principle of linear impulse and momentum, we account for the vector or directional nature of Eq. 7 by expressing it in the form of components in the x and y directions. Thus

$$\Sigma F_x = Q\rho\ (V_2 - V_1)_x$$

$$\Sigma F_y = Q\rho\ (V_2 - V_1)_y$$

where the subscripts on ΣF indicate the summation of the x or y components of the forces acting, and on $(V_2 - V_1)$ the difference in the x or y components of the velocities. From the first equation

$$p_1A_1 - F_x = 2.5 \times 1.94\,(0 - V_1)$$

$$302 - F_x = 4.85\ (-7.17)$$

and from the second

$$Fy - p_2A_2 = 2.5 \times 1.94(V_2 - O)$$

$$Fy - 148.3 = 4.85 \times 12.76$$

therefore

$$F_x = 302 + 34.8 = 337 \text{ lb}$$

$$Fy = 148.3 + 61.9 = 210 \text{ lb}$$

This defines the force in magni-

(continues on page 44)

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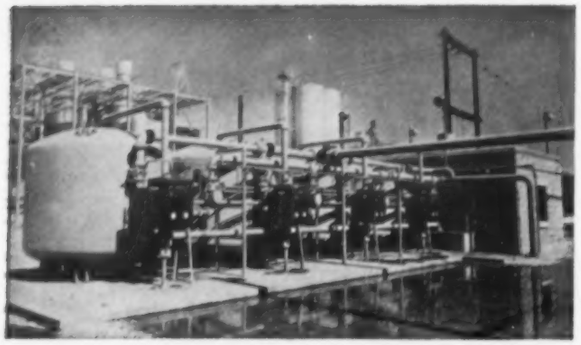

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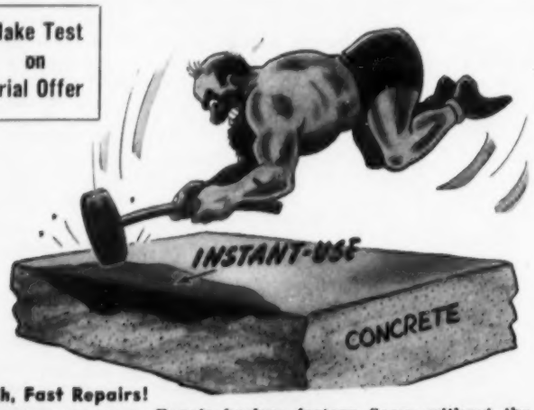

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Fluid Mechanics

. . . starts on page 22

tude and direction:

$$F = \sqrt{337^2 + 210^2} = 398 \text{ lb}$$

$$\theta = \arctan \frac{F_y}{F_x} = \arctan 0.623$$

$$= 31°55'$$

The force we have found represents that exerted on the flowing fluid by the walls of the bend. Since we are assuming that the pipes to which the bend is connected carry none of this force, it must be supplied by an external support or deadman.

The linear impulse-momentum principle is needed to find forces on vanes, bends, and nozzles or contractions in pipes, to analyze rocket and jet propulsion, and to analyze the hydraulic jump in open-channel flow. Angular impulse-momentum or moment of momentum principles are basic to the analysis of the action of pumps and turbines. ♦ ♦

Next month, Professor J. M. Robertson will discuss Fluid Statics and Kinematics.

Operation alert

. . . starts on page 14

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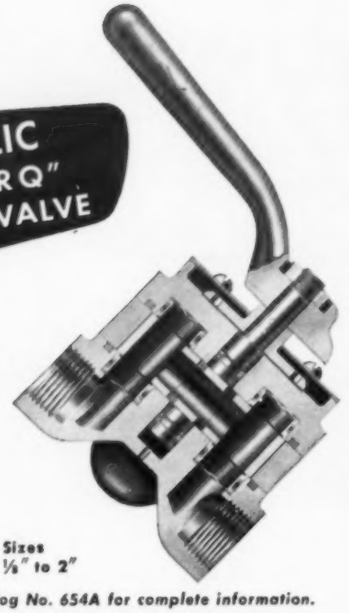

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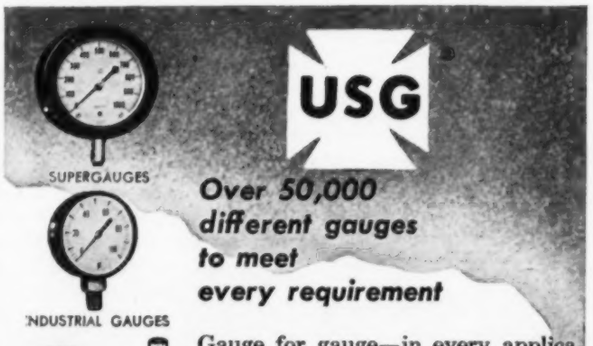

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Pocket-size booklet B-4716-B discusses transformer maintenance, inspection, classification, connections, methods of drying out. Provides handy summary of transformer care for maintenance personnel in power plants. Fifty pages. WESTINGHOUSE ELECTRIC CORP.

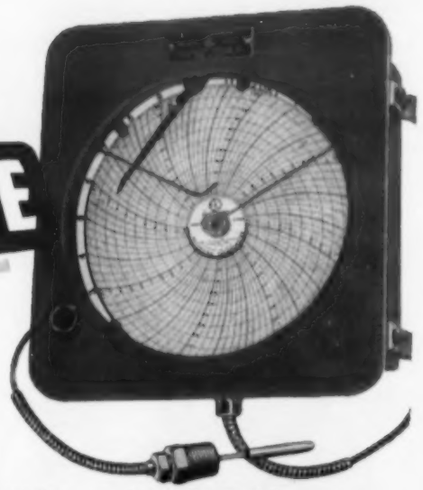
408-Protect your low-voltage circuits

Bulletin 5042-A describes Cordon current limiting circuit breakers for 100,000 rms amperes protection of low voltage distribution circuits. Includes diagram showing typical uses, ratings, operational characteristic curve. Eight pages. I-T-E CIRCUIT BREAKER CO.

603-Save with unit switchgear off the shelf

Adroit engineering at Bridgeport Brass Co. permits tailor-made expansion of electric distribution system with standard, catalog-listed switchgear. Reprinted from June 1956 INDUSTRY POWER.

A NEW
Development from
AUTO-LITE



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TEMPERATURE RECORDERS & INDICATORS

Circle 123 on READ-N-CIRCLE card for more data

604-Lightweight aluminum bus cuts installation costs

Ethyl Corp. engineers designed and built their own aluminum bus to transfer 30,000 dc amps from one rectifier station to another. Reprinted from October 1956 INDUSTRY POWER. (Single copies free).

605-In-plant electric distribution system

Special industry report summarizes trends in distribution of electric power in industrial plant from point where power becomes available to points of utilization, prepared by INDUSTRY POWER staff editors. Special report from INDUSTRY POWER. (Single copies free — 2 to 24 copies, 25¢ each. Quantity prices on request.)

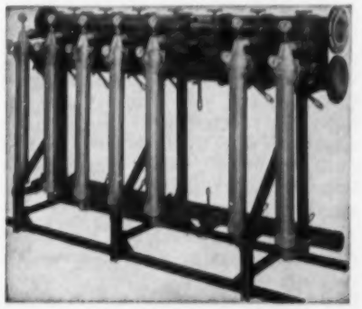
ELECTRIC GENERATION

114-Steam generators out in the open

Installing steam generators outdoors cuts production costs. Package or custom units available. Read page 12—HENRY VOGT MACHINE CO.

(continues on page 48)

ELIMINATE DOWN-TIME
on your Filters and Strainers



Ronningen Model 208 Multiplex Filter with 1 unit removed from line for service—and *all* the others can continue to operate.

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All are Quick Coupling — Non Short-Circuiting. Sealed both ends. Each unit can be back washed and blown down in 5 seconds.

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Write for Bulletin 954P
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You can depend on Brooks rotameter equipment for *lowest final cost* all down the line—because it has been performance-proven where it counts most: in daily service.

Send for your copy of Bulletin 110b, a brief, well illustrated guide to Brooks Rotameters and Accessory Equipment.

BROOKS ROTAMETER COMPANY
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the new standard of flow measurement and control

Circle 144 on READ-N-CIRCLE card

IP handy guide

. . . starts on page 36

147-For emergency or standby power

Mobile generator plant—a powerhouse on wheels—furnishes electric power for emergency or supplementary power needs. Read page 4—WHITE DIESEL ENGINE DIV.

ELECTRIC UTILIZATION

Synchronous machines and their excitation systems

"Power System Stability, Vol. III — Synchronous Machines," by Edward Wilson Kimbard, dean of Seattle University's School of Engineering, presents detailed theory of synchronous machines and their excitation systems, exploring in greater detail subjects briefly covered in Vol. I. Synchronous machine characteristics, reactances, time contants, short-circuit currents, and amortisseur (damper) windings are treated fully. Book helps reader to carry out accurate, detailed stability calculations when simplified methods are inadequate. 322 pages. $10.00. JOHN WILEY & SONS, INC., 440 Fourth Ave., New York 16, N. Y.

ENGINES: DIESEL, GAS, STEAM

409-Integral diesel engine compressor data book

Bulletin 3207 describes 4-cycle V-angle heavy-duty diesel engine with slow-speed horizontal compressor on single crankshaft, thus eliminating gears or other coupling. SVO diesel compressor comes in five sizes with from 4 to 12 power cylinders. Eight pages. INGERSOLL-RAND.

FIRE PROTECTION

410-Economics of fire protection systems

Advantages of fire protection systems both for added safety and for insurance savings are examined in Bulletin 66, "The ABC of Fire Protection." Includes useful chart summarizing characteristics of fixed-temperature and rate-of-temperature rise systems. Thirty-six pages. AUTOMATIC SPRINKLER CORP. OF AMERICA.

606-Tailor-made fire protection

Safe fire protection should be an integral part of facilities it protects. One utility company accomplished this as part of expansion program. Reprinted from September 1955 INDUSTRY POWER.

FUELS AND FIRING EQUIPMENT

113-Your future coal needs anticipated

United Electric anticipates industry's future coal needs by building production facilities for the future. Read page 9 — UNITED ELECTRIC CO.'s.

120-Coal holds the key

The key to better production results may be in the coal you buy. Investigate PM choice coals. Read page 26—PICKANDS MATHER & CO.

124-Stoker firing for economy, dependability

Detroit stokers provide low cost steam, need little power for operation, are dependable. Read page 55 — DETROIT STOKER CO.

100-Power to move a world

Coal fills need for low-cost energy. B&O delivers the coal. Read page 35 — BALTIMORE & OHIO RAILROAD.

108-Dual stage oil burners

Dual stage burners have been thoroughly tested and proved in the field. Read page 43 — NATIONAL AIROIL BURNER CO., INC.

121-Buy the best — buy superwashed coal

America's finest coals are superwashed. Read page 7 — BELL & ZOLLER COAL CO.

129-No smoke, flyash troubles with jet ignition stoker

Stoker gives stable, efficient combustion over wide load range without smoke, almost no flyash. Read page 29 — THE BABCOCK & WILCOX CO.

411-Horizontal rotary oil burner

Rotary oil burner comes in 11 sizes on three chassis with capacities from 7½ to 175 gal/hr. Bulletin 175-L describes special features, including oil feed control that is unaffected by fuel temperature or viscosity changes. Eight pages. PREFERRED UTILITIES MANUFACTURING CORP.

607-Fire either coal or oil

Equipping boilers to fire either coal or oil permits taking advantage of fluctuating fuel prices, gives security of standby fuel in emergencies. Paper Manufacturers Co. can supply all the steam they need using either coal or oil. Reprinted from August 1956 INDUSTRY POWER.

608-Get best coal buy for your company's money

Read how one company evaluates different coals for maximum fuel economy. Includes 12 charts for coal comparison. Reprinted from September 1956 INDUSTRY POWER.

HEAT EXCHANGERS

104-All-aluminum fans are tough

Ask for cooling tower, heat exchanger fan data. Available in 11 sizes, 40- to 132-in. dia. Read page 36 — HARTZELL PROPELLER FAN CO.

412-Heat transfer equipment data

Bulletin DM-1150 includes section of engineering data giving tables of recommended minimum fouling resistances, overall U factors for shell and tube units, tube constants, conversion factors, physical properties of various compounds, properties of saturated steam and water. Equipment described includes heat exchangers, tank suction heaters, oil pre-heaters, condensers, evaporators, aftercoolers, gas coolers, centrifugal pumps, and water heaters. Thirty-two pages. BELL & GOSSETT CO.

INSTRUMENTS AND CONTROLS

123-Temperature recorder uses no ink!

Model 2200 uses no ink to make temperature recordings.

Simplifies maintenance. Read page 47 — THE ELECTRIC AUTO-LITE CO.

148-Gages to meet every requirement

USG gage line meets every price and performance requirement. Read page 44 — UNITED STATES GAUGE.

144-Rotameters measure flow accurately

Practical design features make Brooks Rotameter line ideal for flow measurement or remote transmission. Read page 48 — BROOKS ROTAMETER CO.

141-Flow meter system insures boiler health

Mercuryless flow meter measures fuel and water flow to boiler, steam flow from boiler for quick picture of boiler health. Read page 33 — THE HAYS CORP.

142-Make or break electric circuit

Write for details of differential pressure controls. Read page 34 — THE MERCOID CORP.

413-Automatic controls for cooling towers

Bulletin B-1050 describes newly patented system that automatically controls makeup water flow, chemical feed, blowdown rate of cooling towers. Conserves water and chemicals, reduces manpower, lowers maintenance costs by maintaining correct water level in cooling tower basin. Keeps correct concentration of dissolved solids, controls chemical feed to makeup water. Four pages. BAILEY METER CO.

414-Instrumentation for steam generation

Bulletin 9050R gives details on controls for flow, liquid level, temperature, pressure. Instruments may be used for furnace pressure controllers, scanning systems, automatic reset alarms, coal weighing, flue gas analysis, etc. References for engineer's library listed. Twenty-eight pages. MINNEAPOLIS-HONEYWELL REGULATOR CO.

415-Remote control switches data

Catalog 57-S2 describes remote control switches for economical remote control of power and lighting loads. Includes selection of automatic transfer switches and mechanically held remote control switches for lighting and mixed loads, for discharging and disconnecting field coil, and for oil burner panels. Catalog is indexed. Eighty-two pages. AUTOMATIC SWITCH CO.

609-Rent network analyzers for distribution problems

Modern network analyzers give fast, accurate solutions to problems of industrial electric distribution systems at reasonable cost. Renting an analyzer for a day or so can provide many plans for system improvement that could take months of top engineering time to duplicate. Reprinted from February 1957 INDUSTRY POWER.

610-Switch to centralized control

When can you justify discarding old, but still operating, equipment for new? Corn Products Refining Co. chose between maintaining local boiler controls or switching to new centralized control. Reprinted from June 1956 INDUSTRY POWER.

LUBRICATION

416-Oil circulating system monitors itself

Lubrival circulating oil system for presses and semi-automatic or automatic machine tools, etc. having built-in return oil systems monitors itself. Pressure sensing mechanism warns of clogged or broken lines in any part of the system. Bulletin 70 gives full details. Eight pages. THE FARVAL CORP.

611-Fuel oil additives save

Additives can save fuel, cut down time, simplify maintenance. Learn how additives work, when they are most effective. Reprinted from December 1955 INDUSTRY POWER.

MAINTENANCE ITEMS

122-Rolls 850 tubes in less than 5 hours

Automatic tube expansion control system simplifies and speeds accurate tube rolling. Read page 39 — AIRETOOL MANUFACTURING CO.

101-When you need boiler tubes

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(continues on page 50)

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Other available reprints are listed in the "Handy Guide to Engineering Literature" Section. It starts on page 36 of this issue.

IP handy guide
. . . starts on page 36

Tube Co. representative. Read page 42 — BOILER TUBE CO. OF AMERICA.

136-For expanding heat exchanger tubes

Torq-Air-Matic air-driven tube expander controls tube expansion by measuring torque output at mandrel. Read page 40 — THOMAS C. WILSON, INC.

145-Patch wears like iron

Floor patch bonds tight to old concrete. Easy to apply, won't crack or crumble. Read page 44 — FLEXROCK CO.

131-Planned maintenance helper

Boardmaster Visual Control gives graphic picture of your operations. Save time and money, prevent errors. Read page 51 — GRAPHIC SYSTEMS.

111-Solid steel collars stay put

Solid steel collars that stay put are stocked in 42 sizes. Held on shaft by Unbrako Set Screws. Bulletin 868 describes complete stocks and uses. Read page 38 — STANDARD PRESSED STEEL CO., HALLOWELL POWER TRANSMISSION DIVISION.

417-Cuts round gaskets 1¼ to 22¼ in. od

Bulletin 140 describes gasket cutter for cutting round gaskets from asbestos, rubber, fiber, or cork. Cutter has hexagonal-shaped bar to give positive gripping surface for mounting knife and point holders. THE GARLOCK PACKING CO.

418-Manual gives complete welding data

Catalog 57A is a comprehensive summary of electrode types for most welding applications. Data on each electrode type includes physical properties (as welded), typical chemical analysis of weld deposit, welding procedure, recommended current values, applications. Includes chart of approximate electrode requirements per foot of weld on common types of joints plus AISI SAE standard steel analysis tables. Forty-two pages. THE CHAMPION RIVET CO.

MATERIALS HANDLING (BULK)

109-Silo stores calcined coke

Super-Concrete stave storage bins solve a variety of difficult bulk materials storage problems. Read page 42 — THE NEFF & FRY CO.

612-Conveyors for hot materials

Efficient, low-cost handling of hot bulk materials (over 400 F) demands careful selection of proper conveyor system components. Reprinted from September 1954 INDUSTRY POWER.

613-Bulk handling as a business

Case history tells how one California company processes bulk rubbish to salvage useful materials. Economical, dependable conveyor operation is vital to process. Reprinted from December 1954 INDUSTRY POWER.

NUCLEAR

419-Engineering for atomic power

War- and peace-time atomic energy projects handled by Stone & Webster are described in new bulletin. Recent nuclear projects include Shippingport reactor, APPR, Brookhaven accelerator, Pennsylvania Power & Light Co. homogeneous reactor. Thirty-eight pages. STONE & WEBSTER ENGINEERING CORP.

PIPING, TUBING, AND HOSE

138-Seamless metal hose assemblies

Use custom-constructed hose assemblies for your power system. All sizes available for any application. Read page 51 — COBRA METAL HOSE.

PUMPING EQUIPMENT

112-Do you handle heavy fuel oil?

SU pump unit handles heavy fuel oils. Large choice of pumps and motors. Read page 3 — TUTHILL PUMP CO.

103-Save Btu's cut kw costs!

Mechanical seals for boiler feed pump service can save you dollars. Read page 56 — BYRON JACKSON PUMPS INC.

How to choose right pump for your needs

"Pump Selection and Application," by Tyler G. Hicks, Cooper Union School of Engineering instructor, gives step-by-step procedures for analyzing pumping problems, finding best commercial pump for the job, and applying pump to specific application. Author reviews pumping problems encountered in power plants, nuclear-energy applications, water supply, sewage, hydraulics, air conditioning, and heating. 422 pages. $8.50 McGraw-Hill Book Co., Inc., 330 West 42nd Street, New York 36, N. Y.

REFRACTORIES AND INSULATION

420-Bibliography on refractory concrete

Manual on Lumnite cement mortar for gun-applied linings and masonry includes bibliography of 68 reference articles on refractory concrete. Manual also gives data on mortar preparation, placing procedure, specific instructions for gun-applied linings in power plants, oil refineries, etc. Appendix includes notes on properties of commonly used mortar aggregates, tables of concrete lining weights and of thermal conductivities of Lumnite. Twenty-eight pages. Universal Atlas Cement Co.

614-Permanent tank insulation costs less

Added cost of permanent insulation on bulk fuel storage tanks may be more than offset by lower heating costs when fuel is stored at correct temperature. In some permanent installations cost is recovered within four months. Reprinted from April 1955 Industry Power.

REFRIGERATION

615-Air conditioning and refrigeration basics

Five-part series reviews basic refrigeration principles. Covers air refrigerators and heat pumps, mixtures of gases, gases and vapors, air conditioning processes, properties of refrigerants. Provides a thorough reference on air conditioning and refrigeration processes. Forty-eight pages. Reprinted from Industry Power. (50¢ per copy – send check or money order – quantity rates on request.)

TRAPS, STRAINERS, AND SEPARATORS

137-Compressed air drainage traps

Choose the right trap to drain your compressed air system from 3 types. Read page 34 – Armstrong Machine Works.

143-Cut filter, strainer downtime

Headers, filters, and valves are quick coupling, non-short-circuiting. Read page 47 – Ronningen-Petter Co.

421-Engineering specs on steam specialties

Fully indexed Catalog 69 tells how to select steam traps, gives capacity tables to speed selection. Also includes data on air traps, ball-float traps, strainers, separators, pressure regulating and reducing valves, block steel valves, and engine stops. Handy reference data includes table of areas and diameters of circles, chart for sizing gravity return piping, chart for sizing steam supply piping, table of properties of saturated steam. Sixty pages. Strong, Carlisle & Hammond.

VALVES AND REGULATORS

134-Selector valves for 0 to 6000 psi

Valves in semi-steel, bronze, or aluminum alloy have low turning torque. Three types of portings. Read page 44 – Republic Manufacturing Co.

117-High-pressure liquid ends

Ball-guiding cone seat type valves may be spring-loaded for down-stream pumping and viscous materials to 30,000 SSU. Read page 27 – Philadelphia Pump & Machinery Co.

132-Water reducing valve has 50% more capacity

Large bowl construction and long stroke diaphragm gives full flow of water, other noncorrosive liquids. Read page 19 – Leslie Co.

422-General-purpose valve manual

Gate, globe, and angle valves in sizes from 1/4 through 2 inches are described in Bulletin F-9, supplement 1. Also includes pressure-temperature rating chart for carbon and alloy steel valves. Dimensional-sectional views of 11 available valve configurations are given. Thirty-two pages. Henry Vogt Machine Co.

423-Why not try a solenoid valve?

If you use direct operated solenoid valves for automatic or remote flow control of liquids and steam up to 400 F or of high viscosity liquids, you will want to read Bulletin V-2. Normally closed, normally open, explosion-proof normally closed, 3-way valves are shown. Eleven pages. The Johnson Corp.

WASTE DISPOSAL

616-Put dissolved air to work

Recovering suspended or colloidal materials from process liquors cleans up waste waters, recovers useful raw materials. Colloidair system gives efficient separation at low cost. Tearsheet from February 1955 Industry Power.

617-Industrial waste treatment report

Special industry report on stream polution, including waste treatment facilities, industry liabilities, installation and maintenance costs of treating facilities. Special report from Industry Power. (Single copies free – 2 to 24 copies, 25¢ each. Quantity prices on request.)

WATER SUPPLY AND TREATMENT

105-Boiler feedwater for power plants

Case history shows astonishing success of Illco-Way IonXchange deionization units. Read page 32 – Illinois Water Treatment Co.

146-Choose package water softeners

Preassembled package water softeners save installation costs. Perfect fit for all components is assured. Read page 25 – L•A Water Softener Co.

149-Cold water reactor softens, clarifies

Solids contact reactor provides a cold water process for removing color, turbidity, alka-

(continues on page 52)

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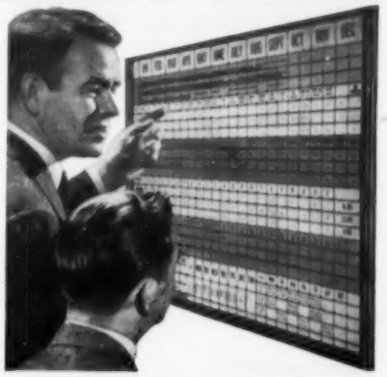

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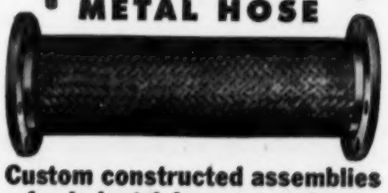

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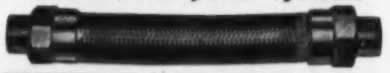

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linity, silica, fluorides from well or surface water. Read page 49 — COCHRANE CORP.

106-Demineralization system to meet your needs

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150-Complete boiler feedwater treatment

Complete plants for all feedwater requirements. Over 50 years experience. Read page 44 — HUNGERFORD & TERRY, INC.

139-Chemicals versus equipment

Let Elgin specify water treating chemicals or conditioning equipment to suit your exact needs. Read page 38 — ELGIN SOFTENER CORP.

424-How to supply your own water

Methods of abstracting water from the ground or by infiltration through permeable beds of rivers or other bodies of water are discussed in bulletin. Performance charts for this company's collector are supplemented with cross-sectional drawings and cutaways. Twenty pages RANNEY METHOD WATER SUPPLIES, INC.

618-Inplant testing for your boiler water

On-the-spot testing of boiler feedwater permits constant, efficient control without delay. Results are lower operating cost, less maintenance. Reprinted from October 1956 INDUSTRY POWER.

619-Millwater system saves $$$

By recirculating plant water, Ford engineers make do with existing water supply system, yet satisfy all plant water requirements. Result is substantial savings each year over cost of additional water supplies. Reprinted from November 1956 INDUSTRY POWER.

620-Small filters do big job

Removing troublesome iron from deep well waters can be done with fine mesh wire cloth filter. Case histories illustrate success of this method. Reprinted from September 1954 INDUSTRY POWER. ♦ ♦

IP coming events

Aug. 7-9:
Denver Research Institute Conference on Industrial Applications of X-ray Analysis; Albany Hotel, Denver.

Aug. 11-15:
ASME National Conference on Heat Transfer and Industrial Exhibit; Pennsylvania State University, University Park.

Aug. 28-30:
ISA National Gas Chromatography Conference; Michigan State University, East Lansing.

Aug. 28-30:
AIEE Pacific General Meeting; Pasco, Wash.

Sept. 4-6:
AIEE-IRE Technical Conference and Exhibit on Magnetic Amplifiers; Penn Sheraton, Pittsburgh.

Sept. 9-13:
ISA Instrument-Automation Conference and Exhibit; Cleveland Auditorium, Cleveland.

Sept. 9-13:
Illuminating Engineering Society National Technical Conference; Biltmore Hotel, Atlanta, Ga.

Sept. 23-25:
ASME Fall Meeting; Hotel Statler, Hartford, Conn.

Oct. 7-9:
ASLE-ASME Lubrication Conference; Royal-York Hotel, Toronto.

Oct. 7-9:
National Electronics Conference; Hotel Sherman, Chicago.

Oct. 7-10:
Federation of Sewage & Industrial Wastes Association Annual Meeting; Statler Hotel, Boston.

Oct. 7-11:
AIEE Fall General Meeting; Chicago.

Oct. 8-9:
Industrial Coal Conference; Purdue University, West Lafayette, Ind.

Oct. 10-11:
National Noise Abatement Symposium; Hotel Sherman, Chicago.

Oct. 10-12:
AIME Fuels Conference; Chateau Frontenac, Quebec.

Oct. 21-23:
Engineers' Society of Western Pennsylvania Annual Water Conference; Penn Sheraton, Pittsburgh.

Oct. 21-25:
National Safety Congress and Exposition; Chicago.

Oct. 28-31:
Trade Fair of the Atomic Industry; Coliseum, New York City.

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500	G.E.	4160/2300	250
400	A.C.	2300	120/240
300	G.E.	440	250
250	G.E.	440	250
200	G.E.	2300	250/275
200	Westg.	2300/4000	250/275
200	Ridgeway	2400	250
170	G.E.	440	125
150	G.E.	2300	125/250
150	A.C.	2300	275
150	Westg.	2300	125/250
150	G.E.	440	275
125	Cr-Wh	(3)4160	125
100	G.E.	2300	250
100	Al-Ch.	2300	250
100	Elec.-Mch	440	125
100	G.E.	440	125
90	G.E.	220/440	125
75	G.E.	440	125
50	Reliance	440	250
50	Ideal	2300	250

Squirrel Cage MOTORS
3 Phase, 60 Cycle, 220 or 440 Volts (*2300 volts or higher)

HP	Make	Type	Speed
1250	*al-CH (3)	ANX	3600
1200	*Al-Ch.	ARW	1200
750	*Westg.	CS	900
500	*Al-Ch.	ARW	3500
500	Gen. Elec.	K-6345	1200
500	G.E.	KT-424	458
350	*G.E.	KT-559A	1800
250	West CS-81205	TEFC	1808
250	B.E. (2)	KT-559	1800
250	*L-Allis	OEX-148	720
250	*G.E.	IK	600
250	G.E.	IK-17A	480
250	West.	CS-14	514
200	G.E.	FT-549Y	3600

Slip Ring MOTORS
3 Phase, 60 Cycle, 220 or 440 Volts (*2300 volts or higher)

HP	Make	Type	Speed
2500	*G.E.	MT	257
1200	*Al-Ch	ANT	1800
600	*G.E.	MT	458
500	G.E.	M-6345	1200
380	G.E.	IM-178	600
250	*G.E.	IM	720
200	G.E.	IM	600
200	Westg. (2)	CW	514
200	*Westg.	CW-905-A	514
150	Cr-Wh.	50-R	1800

Synchroneous MOTORS
3 Phase, 60 Cycle, 220 or 440 Volts (*2300 volts or higher)

HP	Make	Type	P.F.	Speed
1420	Westg.	HG	.7	900
400	Westg.	HG	1.0	900
300	G.E.	ATI	.8	720
300	*Ideal	SMM	.8	257
275	*G.E. (2)	ATI	1.0	450
250	Al.-Ch.	SYN	1.0	1200
225	G.E.	TS-6244	1.0	300
225	Elec. Mchy.		1.0	360
190	Elec. Mchy.		1.0	720

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1317 W. CERMAK ROAD
CHICAGO 8, ILLINOIS

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BERKLEY, MICH.: P. O. Box 1086, LIncoln 7-3844.
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CINCINNATI 2, OHIO: Tri-State Bldg., Rm. #613, PArkway 1-7733.
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COLUMBUS, OHIO: 81 East State St., CApitol 4-1782.
EUCLID 23, OHIO: 4 East 219th St., REdwood 1-7117.
EVANSVILLE 12, IND.: 2742 Hartmetz Ave., 4-7403.
GREENVILLE, OHIO: 909 E. Main St., LIncoln 8-4275.
INDIANAPOLIS 20, IND.: 5425 College Ave., Clifford 1-9233.
KALAMAZOO, MICH.: 612 Academy St., FIreside 3-2567.
LANSING 1, MICH.: P. O. Box 27, IVanhoe 5-1047.
LOUISVILLE 5, KY.: 2113 Edgehill Rd., JU 2-2087.
MILWAUKEE 16, WIS.: 8407 W. Lisbon Ave., Suite 9, HOpkins 2-0360.
MINNEAPOLIS, MINN.: 814 S. Ninth St., FEderal 6-1645.
ROCK ISLAND, ILL.: 1228 Third Ave., 6-7778.
ST. LOUIS 11, MO.: Box 1923, PLateau 2-4433.
TOLEDO 13, OHIO: 3533 Bowen Rd., LAwndale 1239.

AIRETOOL MFG. CO. . . . . Page 39

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CINCINNATI 15, OHIO: J. A. Gerlach, 1216 Ridge Cliff Rd., VAlley 1-5644.
CLEVELAND 15, OHIO: R. J. Bell, 872 Hanna Bldg., CHerry 1-0181.
DETROIT 35, MICH.: DuBois-Webb Co., 19951 Jas. Couzens Hwy., BR 3-0880.
GRAND RAPIDS 5, MICH.: Art Sporleder, 145 Knapp, N.E.
HOUSTON 6, TEXAS: 2046 Banks St., JAckson 3-5926.
MILWAUKEE 8, WIS.: J. D. Wilson, 4831 W. State St., GR 6-9500.
MINNEAPOLIS, MINN.: Steirly-Evans Co., 2803 Riverside Ave., FIlimore 7019.
SPRINGFIELD, OHIO: 304 S. Center St., FAirfax 3-4988.
ST. LOUIS 3, MO.: L. C. Murphy & Co., 1812 Washington Ave., CH 1-8343.

ARMSTRONG MACHINE WORKS . . . . . Page 34

CHICAGO 6, ILL.: Barrett-Christie Co., 118 N. Clinton St., FRanklin 2-9540.
DES MOINES 9, IOWA: Fred E. Triggs, 200 Plymouth, 3-6976.
DETROIT 3, MICH.: Merlo Steam Equipment Co., 1506 E. State Fair, TW 1-7005.
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KNOXVILLE 5, TENN.: Leinart Engrg. Co., 412 E. Fifth Ave., 5-0363.
LOUISVILLE 2, KY.: Graft Pelle Co., 309 W. Main St., JUniper 2-2466.
MEMPHIS 4, TENN.: Power Equipment Co., 3050 Broad Ave., BR 2-2861.
MILWAUKEE 4, WIS.: The Williams Engineering Co., 331 W. National Ave., EVergreen 4-4220.
MILWAUKEE 3, WIS.: K. F. Hamacher Engineering Co., 2540 W. Wells St., WEst 3-9322.
MINNEAPOLIS 6, MINN.: Blesi-Evans Co., 2803 Riverside Ave., FEderal 9-7019.
ST. LOUIS 3, MO.: O'Brien Equipment Co., 2832 Olive St., JEfferson 3-2091.
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WOOSTER, OHIO: Steam Economies Co., Quinby Bldg., HOward 2-8831.

BABCOCK & WILCOX CO., BOILER DIV. . . . . Page 29

NEW YORK 17, N. Y.: (Home Office) 161 E. 42nd St.

BALTIMORE & OHIO RAILROAD . . . . . Page 35

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CINCINNATI 2, OHIO: M. S. Hall, Temple Bar Bldg., Court & Main Sts.
CLEVELAND 13, OHIO: C. H. Norris, Jr., 901-03 Terminal Tower Bldg.
DETROIT 26, MICH.: C. E. Schroeder, 154 W. Lafayette Blvd.

BELL & ZOLLER COAL CO. . . Page 7

CHICAGO, ILL.: (Home Office) 307 N. Michigan Ave.

BETZ LABORATORIES, INC. . . Page 11

PHILADELPHIA 24, PA.: (Home Office) Gillingham & Worth Sts.

BOILER TUBE CO. OF AMERICA . . . . . Page 42

CHICAGO, ILL.: STate 2-7955.
CLEVELAND, OHIO: YEllowstone 2-6105.

BROOKS ROTAMETER CO. . . Page 48

ATLANTA 6, GA.: Boiler Equipment Service Co., 686 Greenwood Ave., N.E.
CHICAGO, ILL.: J. R. Simpson & Co., 1210 S. 17th Ave., Maywood, Ill., FIllmore 5-1613.
CINCINNATI 8, OHIO: The Abbott Co., P. O. Box 41, EAst 2349.
CLEVELAND 20, OHIO: Chemical Pump & Equip. Corp., 3537 Lee Rd., SWeetbriar 5-4900.
DAYTON, OHIO: The Abbott Co., 407 Realty Bldg., FUlton 7203.
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DETROIT 7, MICH.: Smith Instrument & Equipment Co., 1900 E. Jefferson Ave., LOrain 7-3550.
INDIANAPOLIS 2, IND.: The Laidlaw Co., 1606 N. Illinois St., WAlnut 3-4558.
KINGSPORT, TENN.: Abernathy-Thomas Engineering Co., 341-345 West Market St., CIrcle 5-6151.
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MEMPHIS 17, TENN.: Engineered Instrument Sales Co., 2717 Union Ave.
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ST. LOUIS 17, MO.: The E. B. Miller Co., 6636 Clayton Rd.

BUELL ENGINEERING CO. . . . Page 37

NEW YORK, N. Y.: (Home Office) 70 Pine St.

BULLDOG ELECTRIC PRODUCTS CO. . . . . Page 31

CHICAGO 6, ILL.: A. G. Curtin, 600 W. Jackson Blvd., Rm. 513, CEntral 6-3945; G. A. Fassnacht, 600 W. Jackson Blvd., Rm. 413, RAndolph 6-1895.
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MILWAUKEE 1, WIS.: C. L. Seaholm, P. O. Box 1664, COncord 4-7100.
MINNEAPOLIS 26, MINN.: Alton M. Johnson Co., 3119 Lynn Ave., WAlnut 7-8741.
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BYRON JACKSON PUMPS, INC. . . . . Page 56

See local office listing on Page 56.
LOS ANGELES 54, CALIF.: (Home Office) Box 2017, Terminal Annex.

COBRA METAL HOSE, DIV. OF DK MFG. CO. . . . Page 51

CHICAGO, ILL.: Power Transmission Equipment Co., 1245 West Fulton St.
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COCHRANE CORPORATION . Page 49

CHICAGO 6, ILL.: Cochrane Engineering Corp., 309 W. Jackson Blvd.
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MINNEAPOLIS, MINN.: Bell & Elss, Inc., 2102 Foshay Tower.
ST. LOUIS 1, MO.: Lane Machinery Co., 7th & Market Sts.

DETROIT STOKER CO. . . . . Page 55

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CINCINNATI, OHIO: Detroit Stoker Co., 2904 Woodburn Ave.
CLEVELAND, OHIO: Detroit Stoker Co., 1621 Euclid Ave.
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MINNEAPOLIS, MINN.: Detroit Stoker Co., Foshay Tower.
NASHVILLE, TENN.: Allen-Shuff Corp., 1121 Church St.

ELECTRIC AUTO-LITE CO. . . Page 47

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TOLEDO 1, OHIO: 1201 Champlain St., CHerry 3-3131.

ELGIN SOFTENER CORP. . . . . Page 38

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ST. LOUIS 1, MO.: F. S. Crook, 1004 Market St., CHestnut 1-3511.

FLEXROCK CO. . . . . Page 44

PHILADELPHIA 1, PA.: (Home Office) 3609 Filbert St.

GLOBE CO. . . . . Page 41

CHICAGO, ILL.: Steel Sash Service, Inc., 2141 Lawrence Ave., UP 8-7500.
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GRAPHIC SYSTEMS INC. . . . Page 51

NEW YORK, N. Y.: (Home Office) 55 W. 42nd St.

HARTZELL PROPELLER FAN CO. . . . . Page 36

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CHICAGO 40, ILL.: Williamson and Co., 1249 Devon Ave., BRiargate 4-2620.
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ROCK ISLAND, ILL.: Carroll and Assoc., 3209-35th Ave., 6-7519.
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(more locator on page 54)

the LOCATOR

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THE HAYS CORP. .....Page 33

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DETROIT 27, MICH.: Clifford B. Armstrong, Jr., 16817 Gr. River Ave., VE 8-4248.
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ILLINOIS WATER TREATMENT CO. .....Page 32

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CHICAGO 45, ILL.: Bob Goynshor, 7546 No. Oakley Ave., AMbassador 2-5317.

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DETROIT, MICH.: McBride-Pearson, TRinity 2,8000.
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COLUMBUS 1, OHIO: 1130 N. High St.
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PEORIA, ILL.: 1422 N. Adams St.
SAGINAW, MICH.: 1840 N. Michigan St.
ST. LOUIS 3, MO.: 3541 Lawton Blvd.
SOUTH BEND 18, IND.: 105 W. Garst St.
TOLEDO 6, OHIO: 3239 Monroe St.
WILMETTE, ILL.: 400 Linden Ave.
YOUNGSTOWN 2, OHIO: 3743 South Ave.

L*A WATER SOFTENER CO. . .Page 25

GLENDALE 1, CALIF.: (Home Office) 1007 Air Way.

THE JAMES LEFFEL & CO. Page 12

SPRINGFIELD, OHIO: (Home Office) 426 East.

LESLIE CO. .....Page 19

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CHICAGO, ILL.: Instrument Associates.
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CLEVELAND, OHIO: W. M. Wilson Co.
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DES MOINES, IOWA: W. W. Stuart.
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INDIANAPOLIS, IND.: Young-Streeter Co.
KANSAS CITY, MO.: Mooney Engrg. Co., Inc.
KINGSPORT, CHATTANOOGA, TENN.: Abernathy-Thomas Engineering Co.
MEMPHIS, TENN.: Power Equipment Co.
MINNEAPOLIS, MINN.: Plant Equipment, Inc.
ST. LOUIS, MO.: Roger P. Kipp Co., Inc.
YOUNGSTOWN, OHIO: Brenner Industrial Sales & Supply Co.

THE MERCOID CORP. .....Page 34

CINCINNATI, OHIO: The Richard Equipment Co., 2137 Reading Rd.
CLEVELAND, OHIO: R. G. Davis & Co., 15963 Euclid Ave.
DETROIT 2, MICH.: R. L. Deppmann Co., 1120 W. Baltimore.
INDIANAPOLIS 2, IND.: Electro Products, Inc., 702 E. 10th St.
MILWAUKEE 2, WIS.: Hansen Engr. Co., 315 E. Detroit St.
ST. LOUIS 10, MO.: Fillo Sales & Engr. Co., 4401 Chouteau Ave.
TOLEDO 2, OHIO: Girkens Electric Co., 2056 Canton St.

MONARCH ELECTRIC CORP .....Page 38

JAMESTOWN, N. Y.: (Home Office) 118 E. First St.

MULTI-AMP CORP. .....Page 49

UNION, N. J.: (Home Office) 467 Lehigh Ave.

NATIONAL AIROIL BURNER CO. .....Page 43

PHILADELPHIA 34, PA.: (Home Office) 1350 E. Sedgley Ave.

NEFF & FRY CO. .....Page 42

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CEDAR RAPIDS, IOWA: R. F. Horak, 2911 Meadowbrook S.E., 2-6187.
CHICAGO 5, ILL.: W-M Corp., 608 South Dearborn St., HArrison 7-7778.
MARQUETTE, MICH.: C. T. DeHaas Co., Box 89, Phone 320 or 321.
SAGINAW, MICH.: H. C. Roeser, Box 175, W. S. 2-6031.
ST. LOUIS 24, MO.: Missouri Construction Machinery Co., 8861 Ladue Rd., PArkview 7-5748.

NIAGARA BLOWER CO. ....Page 32

NEW YORK 17, N. Y.: (Home Office) 405 Lexington Ave.

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PHILADELPHIA 16, PA.: (Home Office) 13500 Philmont Ave.

PICK MFG. CO. .....Page 34

CLEVELAND 6, OHIO: John McGuckin, 1416 E. 93rd St.
DETROIT 38, MICH.: Steam Specialties Co., 15794 Wyoming Ave.
KANSAS CITY, MO.: Whitney M. Kerr Co., 1415 Penn. Ave.
MINNEAPOLIS, MINN.: Ruffridge-Johnson Equipment Co., 3025 S. E. 4th St.
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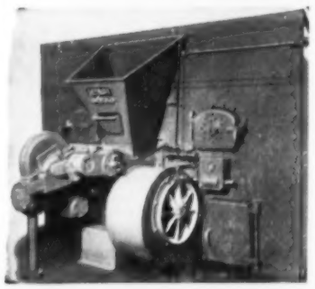

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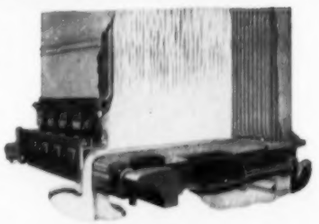

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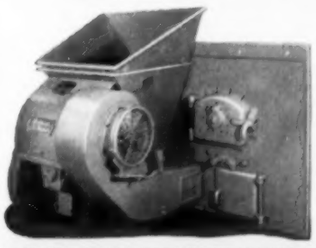

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